EPA APPROVED

ALUMINUM

TOTAL MAXIMUM DAILY LOAD (TMDL) Updates FOR THE Middle Rio Grande Basin

APRIL 27, 2018

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LIST OF ABBREVIATIONS AND DEFINITIONS

AU	Assessment Unit
BMP	Best management practices
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CGP	Construction general storm water permit
CoolWAL	Cool Water Aquatic Life
CWA	Clean Water Act
CWAL	Cold Water Aquatic Life
ºC	Degrees Celsius
ºF	Degrees Fahrenheit
HUC	Hydrologic unit code
km^2	Square kilometers
LA	Load allocation
lbs/day	Pounds per day
mgd	Million gallons per day
mg/L	Milligrams per liter
mi^2	Square miles
mL	Milliliters
MCWAL	Marginal Coldwater Aquatic Life
MOS	Margin of safety
MOU	Memorandum of Understanding
MRG	Middle Rio Grande
MS4	Municipal separate storm sewer system
MSGP	Multi-sector general storm water permit
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
QAPP	Quality Assurance Project Plan
RFP	Request for proposal
SLO	State Land Office
SWPPP	Storm water pollution prevention plan
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
UAA	Use Attainability Analysis
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WBP	Watershed-based plan
WLA	Waste load allocation
WQCC	Water Quality Control Commission
WQS	Water quality standards (20.6.4 NMAC as amended through February 13, 2018)

EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act, 33 U.S.C. §1313[1], requires states to develop Total Maximum Daily Load (TMDL) management plans for water bodies determined to be water quality limited. A TMDL is defined as "*a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards including consideration of existing pollutant loads and reasonably foreseeable increases in pollutant loads*" (USEPA, 1999). A TMDL defines the amount of a pollutant a waterbody can assimilate without violating a state's water quality standards (WQS). It also allocates that load capacity to known point sources and nonpoint sources at a given flow. It further identifies potential methods, actions, or limitations that could be implemented to achieve water quality standards. TMDLs are defined in 40 Code of Federal Regulations Part 130 (40 C.F.R. § 130.2) as the sum of the individual Waste Load Allocations (WLAs) for point sources and Load Allocations (LAs) for nonpoint source and background conditions. They also include a Margin of Safety (MOS) in acknowledgement of various sources of uncertainty in the analysis.

The Assessment Unit (AU) Rio Grande (San Marcial at USGS Gage to Rio Puerco) was first listed for dissolved aluminum on the 2008 Clean Water Act §303(d)/ §305(b) Integrated Report and List (IR), as a result of assessment data generated during the 2005 Middle Rio Grande (MRG) water quality survey. A TMDL was completed and approved in 2010 (NMED/SWQB, 2010). In 2012, the US Environmental Protection Agency (USEPA) approved the New Mexico Water Quality Control Commission (WQCC) adoption of a hardness-based standard for total recoverable aluminum (TR Al), in place of the former standard for dissolved aluminum. The New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB) conducted another water quality survey of the MRG and its tributaries in 2014. At that time the AU was split into Rio Grande (San Marcial at USGS gage to Arroyo de las Canas) and Rio Grande (Arroyo de las Canas to Rio Puerco). Both AUs exceed the new aluminum standard. Total recoverable aluminum was first listed as a cause of aquatic life use (ALU) non-support for the Rio Grande between San Marcial and the Rio Puerco in 2016. In addition to the aluminum impairments, the Rio Grande (Arroyo de las Canas to Rio Puerco) is listed for *E. coli* and copper, and the Rio Grande (San Marcial at USGS gage to Arroyo de las Canas) is listed for temperature. The 2010 report assigns a TMDL for the *E. coli* impairment. No TMDL has been completed yet for the copper and temperature impairments, which are based on 2014 survey data.

The AU "Jemez River from Rio Guadalupe to the confluence of the East Fork of the Jemez River and San Antonio Creek" was first listed for dissolved aluminum on the 2000 Clean Water Act §303(d)/ §305(b) Integrated Report and List (IR), as a result of assessment data generated during a water quality survey of the Jemez River watershed conducted in 1998-1999. A TMDL was completed in 2002 and approved in 2003 (NMED/SWQB, 2002). Subsequently, the AU was split into Jemez River (Soda Dam nr Jemez Springs to East Fork) and Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs). As mentioned above, USEPA approved the NM WQCC adoption of a hardness-based standard for total recoverable aluminum, in place of the former standard for dissolved aluminum, in 2012. The NMED Surface Water Quality Bureau (SWQB) conducted another water quality survey of the Jemez River watershed in 2013. Both AUs exceeded the new aluminum standard. Total recoverable aluminum was first listed as a cause of ALU non-support for the Jemez River between the Rio Guadalupe and the East Fork in 2016. In addition to the aluminum impairments, the Jemez River (Soda Dam nr Jemez Springs to East Fork) is also listed for arsenic, *E. coli*, temperature, turbidity and pH. The Jemez River (Rio Guadalupe to Soda Dam nr Jemez

Springs) is listed for arsenic, boron, *E. coli*, nutrients, temperature and turbidity. TMDLs were completed addressing these impairments (NMED/SWQB, 2004, 2009 and 2016a).

The purpose of this report is to update the aluminum TMDL for these four AUs from dissolved to total recoverable aluminum, in accordance with the current WQS. Additional water quality data will be collected by the NMED SWQB during the standard rotational period for water quality stream surveys. As a result, targets will be reexamined and potentially revised as this document is considered to be an evolving management plan. If new data indicate that the targets used in this analysis are not appropriate and/or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be moved to the appropriate attainment category on the Clean Water Act Integrated §303(d)/§305(b) list of waters.

The SWQB Watershed Protection Section will continue to work with watershed groups to develop Watershed-Based Plans (WBPs) and implement strategies that attempt to correct the water quality impairments detailed in this document. Implementation of items detailed in the WBPs will be done with participation of interested and affected parties.

Table ES-1. TOTAL MAXIMUM DAILY LOAD FOR ALUMINUM RIO GRANDE FROM USGS GAGE AT SAN MARCIAL TO RIO PUERCO

New Mexico Standards Segment	Rio Grande Basin 20.6.4.105
Assessment Unit Identifier	NM-2105_11 NM-2105_10
Combined Segment Length	58.01 miles
Parameters of Concern	Aluminum
Designated Uses Affected	Marginal Warmwater Aquatic Life
Geographic Location	Rio Grande-Albuquerque USGS Hydrologic Unit Code 13020203
Scope/size of Watershed	3204 square miles
Land Type	Chihuahuan Desert - Rio Grande Floodplain (24f)
Land Use/Cover	79% shrubland, 7% grassland, 6% evergreen forest, 3% woody wetlands, 2% cultivated crops, 2% developed areas
Probable Sources	Dams/diversions, Irrigated crop production, Residences/buildings, Exotic species, Active exotics removal, Rangeland grazing, Waterfowl, Paved roads, Channelization, Riprap/ Wall/Dike/Jetty Jack, Forest fire runoff
Land Management	33% private, 31% BLM, 20% FWS, 7% State Land Office, and 1% Department of Defense
IR Category	5
Priority Ranking	High
TMDL for:	

Total Recoverable Aluminum	**WLA**	**+**	**LA**	**+**	**MOS**	**=**	**TMDL**
High Flow	34.9	+	50,917	+	8991	=	59,943 lbs/day
Moist	34.9	+	14,867	+	2630	=	17,532 lbs/day
Mid-Range	34.9	+	7124	+	1263	=	8422 lbs/day
Dry	34.9	+	1135	+	206	=	1376 lbs/day

Table ES-2. TOTAL MAXIMUM DAILY LOAD FOR ALUMINUM JEMEZ RIVER (SODA DAM NR JEMEZ SPRINGS TO EAST FORK)

New Mexico Standards Segment	Rio Grande Basin 20.6.4.108
Assessment Unit Identifier	NM-2106.A_00
Assessment Unit Length	3 miles
Parameters of Concern	Aluminum
Designated Uses Affected	High Quality Coldwater Aquatic Life
Geographic Location	Jemez USGS Hydrologic Unit Code 13020202
Scope/size of Watershed	181 square miles
Land Type	Southern Rockies - Volcanic Mid-Elevation Forests (21h) and Foothill Woodlands and Shrublands (21d)
Land Use/Cover	66% evergreen forest, 21% grassland, 5% shrub/scrub, 4% deciduous forest, and 1.3% emergent herbaceous wetland.
Probable Sources	Pavement/ Impervious surface, Residences/ Buildings, Logging Operations – Legacy, Paved Roads, Gravel or Dirt Roads, Rangeland Grazing, Angling Pressure, Watershed Runoff following Forest Fire
Land Management	67% National Park Service, 27% US Forest Service, 6% private
IR Category	5
Priority Ranking	High
TMDL for:	
Aluminum	
	WLA + LA + MOS = TMDL
	0 + 7.23 + 0.8 = 8.03

Table ES-3. TOTAL MAXIMUM DAILY LOAD FOR ALUMINUM JEMEZ RIVER (RIO GUADALUPE TO SODA DAM NR JEMEZ SPRINGS)

New Mexico Standards Segment	Rio Grande Basin 20.6.4.107
Assessment Unit Identifier	NM-2105.5_10
Assessment Unit Length	9 miles
Parameters of Concern	Aluminum
Designated Uses Affected	Coldwater Aquatic Life
Geographic Location	Jemez USGS Hydrologic Unit Code 13020202
Scope/size of Watershed	201 square miles
Land Type	Southern Rockies - Foothill Woodlands and Shrublands (21d)
Land Use/Cover	66% evergreen forest, 21% grassland, 5% shrub/scrub, 4% deciduous forest, and 1.3% emergent herbaceous wetland.
Probable Sources	Pavement/ Impervious surface, Residences/ Buildings, Site Clearance/ Land Development, Rangeland Grazing, Bridges/ Culverts/ RR Crossings, Paved Roads, Gravel or Dirt Roads, Irrigated Crop Production, Angling Pressure, Campgrounds, Watershed Runoff following Forest Fire
Land Management	67% National Park Service, 27% US Forest Service, 6% private
IR Category	5
Priority Ranking	High
TMDL for:	
Aluminum	**WLA + LA + MOS = TMDL** 1.03 + 9.54 + 1.17 = 11.74

1.0 BACKGROUND

1.1 Watershed Description - Middle Rio Grande Study Area

The Rio Grande drainage extends from the southern Colorado Rockies through New Mexico and Texas where it reaches the Gulf of Mexico at sea level. The MRG basin is primarily comprised of alluvial deposits, specifically the Quemado Formation and Upper Santa Fe Group (Figure 1.2). A number of gypsum mines operate in the basin below Cochiti Reservoir. Both the Ortiz and San Pedro Mountains in the Rio Grande basin contain Tertiary volcanic intrusions that pushed up on the east side of the Rio Grande Rift. One result of these intrusions was the formation of turquoise, which has been mined in the area as early as 900 AD (Chronic, 1987). Gold, silver, anthracite coal, and lead were later mined in the mountains surrounding the MRG basin. The 20-mile long Sandia Mountain range flanks the east side of the basin near Albuquerque. The Sandia Mountains are comprised of 1.4 billion year old Precambrian granite covered by 300-million year old Pennsylvanian sedimentary rocks and reach to over 10,000 feet in elevation (Chronic, 1987). South of the Sandia Mountains are the Manzano Mountains which are also fault block mountains. The Albuquerque volcanoes, west of the city, were last active in the Pleistocene Era and similar volcanoes exist south of Albuquerque near Isleta Pueblo. Throughout this area, the Rio Grande Rift is filled with thousands of feet of alluvial deposits. The Albuquerque-Belen basin extends south of Albuquerque and is comprised of similar alluvial terraces as in the Albuquerque area. Small volcanoes also continue south of Albuquerque and include Sierra Lucero and Ladrone Peak (Chronic, 1987).

Figure 1.1 Location of the TMDL study areas within New Mexico.

The Rio Grande floodplain is broad and marshy downstream of the Rio Puerco. The Lemitar Mountains, southwest of the convergence of the Rio Salado with the Rio Grande, consist of a series of Precambrian and Paleozoic rocks. The southernmost end of this range consists of Tertiary lava flows that overlay the Paleozoic sedimentary rocks (Chronic, 1987). Mountains downstream of the Lemitar Mountains include the Los Piños and the Socorro ranges. The former is composed primarily from Pennsylvanian and Permian sedimentary rocks and the latter of volcanic rocks from a former caldera. Continuing southward along the Rio Grande valley are the Magdalena, San Mateo, and Mimbres Mountain ranges. Along the Rio Grande valley in the vicinity of Elephant Butte Reservoir, the rocks to the west of the river continue to be volcanic.

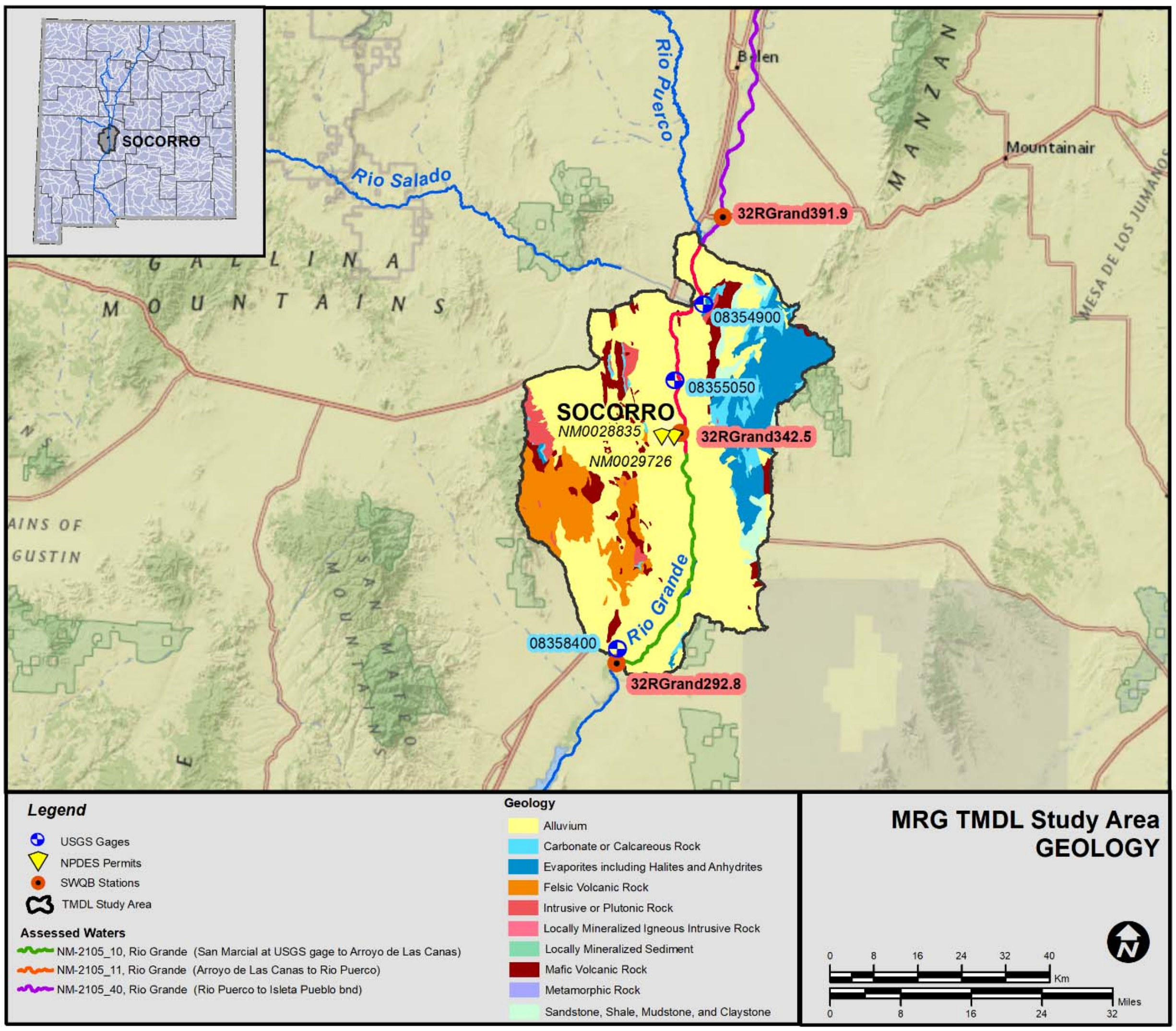


Figure 1.2 Generalized Surface Geology of the Middle Rio Grande TMDL Study Area

The Rio Grande-Albuquerque Hydrologic Unit Code (HUC) 13020203 is located in Sandoval, Bernalillo, Valencia, and Socorro Counties in central New Mexico. The Rio Grande-Albuquerque HUC covers approximately 3,215 square miles (mi^2). The MRG study area for this TMDL report is that portion of HUC 13020203 which drains directly into the two impaired AUs (Figure 1.2), which comprises approximately 1093 mi^2. Land use in the TMDL study area includes 79% shrubland, 7% grassland, 6% evergreen forest, 3% woody wetlands, 2% cultivated crops, and 2% developed areas (Figure 1.3). Land ownership is 33% private, 31% Bureau of Land Management (BLM), 20% US Fish & Wildlife Service, 7% State Land Office, and 1% Department of Defense (Figure 1.4). Figures 1.2 through 1.4 show the location and identity of AUs, water quality sampling stations, flow gages and point source permits which are referred to in the report.

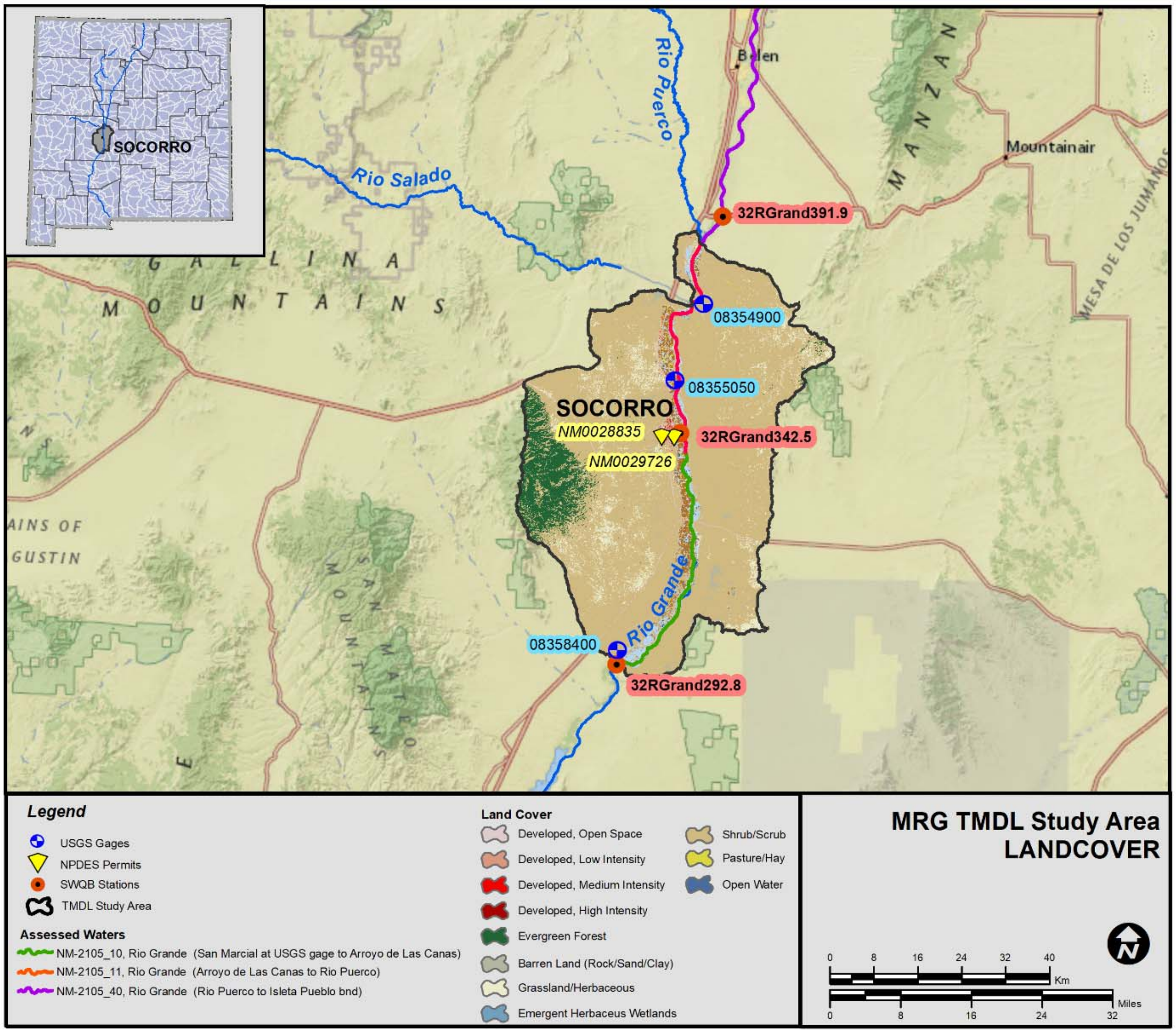


Figure 1.3 Land Cover in the Middle Rio Grande TMDL Study Area

Water from the Rio Grande is diverted to the MRG Conservancy District's Socorro Main Canal at the San Acacia Diversion Dam (Figure 1.4), which is within the SWQB's Rio Grande (Arroyo de las Canas to Rio Puerco) AU. A large amount of sediment has accumulated above the dam. The Bureau of Reclamation's Low Flow Conveyance Channel (LFCC) parallels the Rio Grande and serves as a riverside drain for 54 miles from San Acacia to below San Marcial (Price *et al*, 2007). It was constructed as part of the Middle Rio Grande Project, for the purpose of reducing seepage losses and managing sediment loads as water moves downstream to Elephant Butte Reservoir, and is separated from the river by a spoil levee along the west bank. The portion of the LFCC between the reservoir and the return point at river mile 10, below the San Marcial USGS gage, is no longer maintained. Diversions from the Socorro Main Canal serve agricultural operations throughout both TMDL AUs. No water has been diverted from the LFCC in recent years. It is on average 11 feet lower elevation than the Rio Grande floodway and some subsurface seepage takes place from the river to the conveyance channel. The Bureau of Reclamation has built five pump stations to return water to the river in order to maintain fish habitat when certain low flow thresholds are crossed.

Figure 1.4 Structures at the San Acacia dam which function to release water from the Rio Grande to (A) the Low Flow Conveyance channel and (B) the Socorro Main Canal. The dam is operated by the Middle Rio Grande Conservancy District.

The reach of the Rio Grande from Elephant Butte reservoir to a point north of Arroyo de las Cañas, is subject to aggradation of sediment and is in places higher than the surrounding valley (Price et al, 2007). Arroyo de las Cañas is incised upstream of the Rio Grande and delivers a large amount of very coarse sediment into the river. The floodway, or natural river channel, of the Rio Grande is a single channel in the reach below San Acacia, through the upper AU, becoming braided through the majority of the downstream AU, and may be as wide as 1000 feet in places. Flow is not perennial in all years, through the entire TMDL study area, and there are complex interactions with groundwater (USBR, 2007).

The MRG corridor has very high wildlife habitat value. The TMDL reach includes the State Game Commission's La Joya Wildlife Area, managed specifically for waterfowl, and the Bosque del Apache National Wildlife Refuge, identified by the Audubon Society as a Globally Important Bird Area. Both refuges use Rio Grande water for irrigation. The Bosque del Apache takes up approximately one half of the total length of the Rio Grande (San Marcial at USGS gage to Arroyo Cana) AU. There are 15 species listed as Threatened or Endangered by New Mexico Department of Game & Fish and/or the US Fish & Wildlife Service, which are known to occur in the Rio Grande or its riparian area in the counties of Socorro and Sierra (BISON-M, 2017). The river corridor in the TMDL study area includes designated Critical Habitat for the federally Endangered Rio Grande silvery minnow (*Hybognathus amarus*) meadow jumping mouse (*Zapus hudsoneus luteus*), and southwest willow flycatcher (*Empidonax traillii extimus*), and proposed Critical Habitat for the federally Threatened yellow-billed cuckoo (*Coccyzus americanus*). Major efforts to remove the invasive woody plant tamarisk, or salt-cedar (*Tamarisk spp.*) have been ongoing on the Bosque del Apache and elsewhere in the TMDL reach. Tamarisk beetles have had an impact on the tamarisk stands in this area beginning in 2016. Recent fires have occurred in tamarisk and cottonwood stands at the Bosque del Apache and at San Antonio (immediately north of the refuge).

Native American communities, including Pueblo, Navajo, and Apache groups have occupied the region since the early 1300's. The valley has undergone drastic changes since pre-colonial times. Since early Spanish occupancy, the basin has experienced irrigated farming, grazing, fire suppression, and intensive hunting, along with the introduction of exotic plants, droughts, and floods (Scurlock, 1998). Spanish settlements eventually extended from north-central New Mexico down river to Cochiti and as far south as Socorro. Missions reached the Bernalillo to Isleta Pueblo reach of the Rio Grande by the mid 1620's. The Spanish province in New Mexico was divided into two administrative units, the lower reach between Cochiti and Socorro was named Rio Abajo

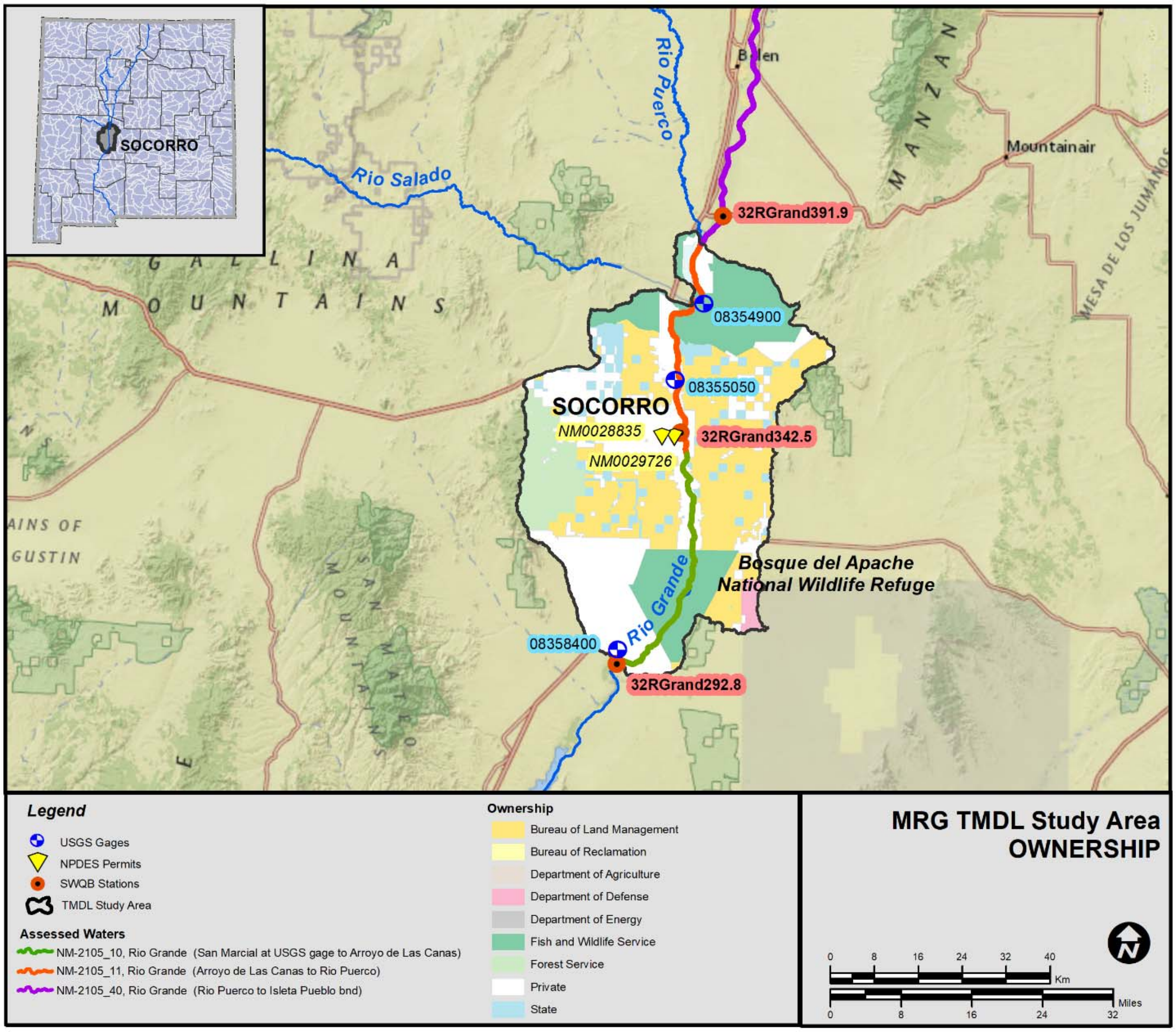


Figure 1.5 Middle Rio Grande TMDL Study Area Land Ownership

(Scurlock, 1998). Spanish land grants were issued in the late 1700's through the early 1800's and the farming and grazing that occurred on these land grants continue to be an important part of the cultural identity of the basin. The first non-Spanish Europeans in the Rio Grande valley were French trappers from the Mississippi Valley who arrived during the 18th and early 19th centuries. (Scurlock, 1998). The Santa Fe Trail from Missouri linked up with the Camino Real which followed the Rio Grande into Mexico. Settlements in the Rio Grande Valley continued as the railroad was established in the region. The Middle Rio Grande Valley currently supports diverse land uses, from agriculture to the largest municipality in the state (Albuquerque, founded in 1706).

1.2 Watershed Description – Jemez Study Area

The Jemez River, a tributary to the Rio Grande, is formed by the convergence of the East Fork of the Jemez River and San Antonio Creek. Both headwater streams originate in volcanic rocks, principally basalts and Bandelier tuffs, associated with the Valles Caldera. The Valles Caldera, now managed by the National Park Service, is a volcanic caldera which erupted twice, a little over one million years ago, ejecting huge volumes of volcanic gases, ash, pumice and rock fragments. The two massive eruptions depleted the magma chamber beneath the volcano. No longer supported from below, the volcano, ringed by fractures, collapsed, forming a vast caldera 14 miles across. At the confluence of the East Fork of the Jemez River and San Antonio Creek, the Jemez River cuts through the volcanic rock and into a series of sedimentary strata that form the valley floor in the TMDL area (NMED/SWQB, 2015a; Figure 1.6). The Rio Guadalupe is a major tributary that flows into the Jemez River from the west, approximately 31 miles upstream of the Rio Grande.

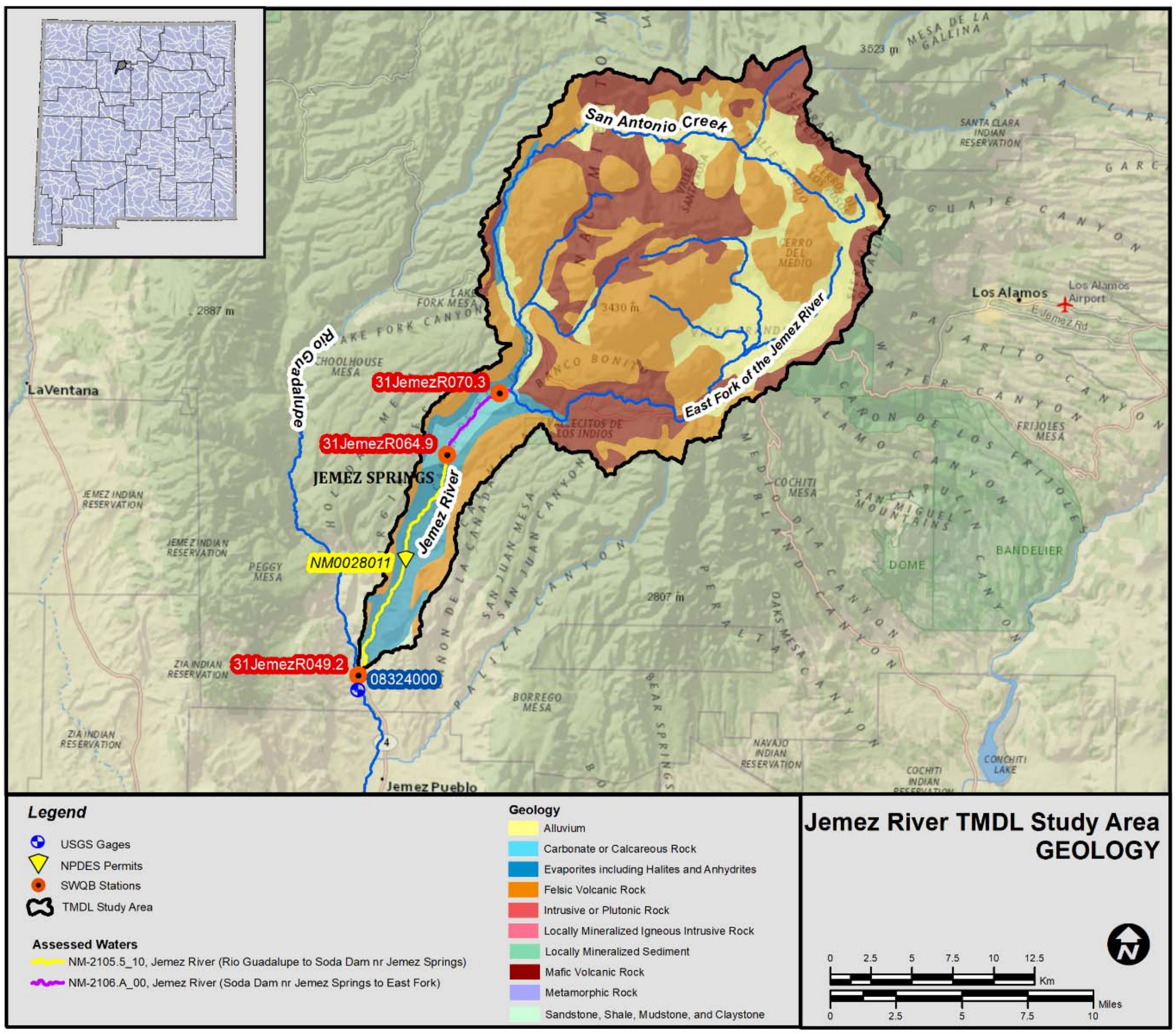


Figure 1.6 Generalized surface geology of the Jemez River TMDL Study Area

The Jemez River from Rio Guadalupe to the confluence of the East Fork of the Jemez River and San Antonio Creek, is a 45 mi^2 drainage area within Sandoval County. Land uses include ranching, silviculture, recreation, mining (including two reclaimed pumice mines) and some urban and residential development, including the village of Jemez Springs. Land cover in the watershed is 66% evergreen forest, 21% grassland, 5% shrub/scrub, 4% deciduous forest, and 1.3% emergent herbaceous wetland (Figure 1.6). The primary landowners are the National Park Service (67%) and the US Forest Service (27%). The remainder is privately owned (Figure 1.8).

The AUs of the Jemez River which are impaired for TR Al are divided by Soda Dam hot spring, just above the village of Jemez Springs. Approximately 1500 L/min (0.88 cfs) geothermal water from the Valles Caldera system enters the Jemez River from Soda Dam and associated features in the vicinity of Jemez Springs (Reid et al, 2003). Hardness, from which the TR Al WQS is calculated, is approximately two times greater in the Jemez River below Soda Dam, as compared to above it.

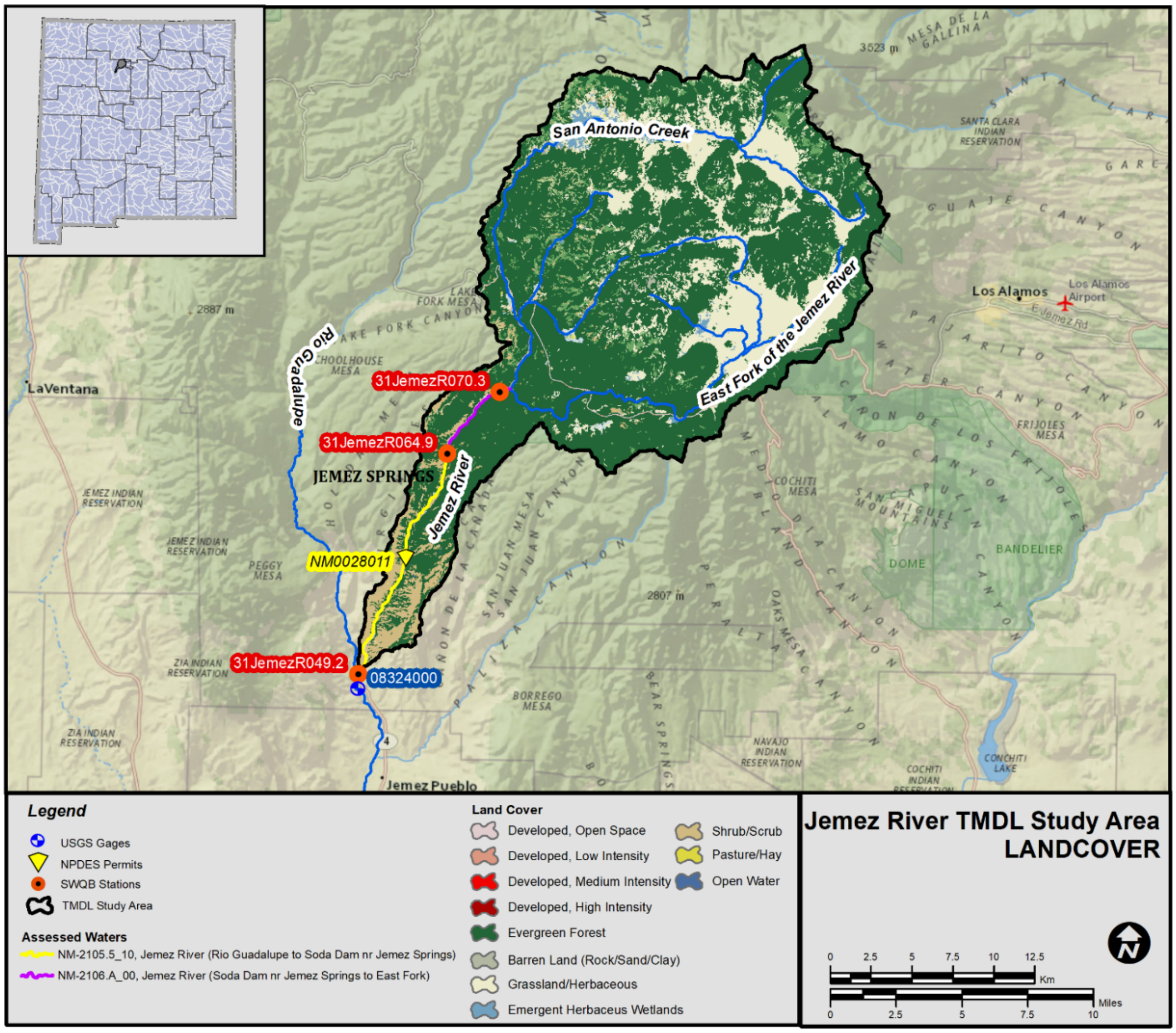


Figure 1.7 Land cover in the Jemez River TMDL Study Area

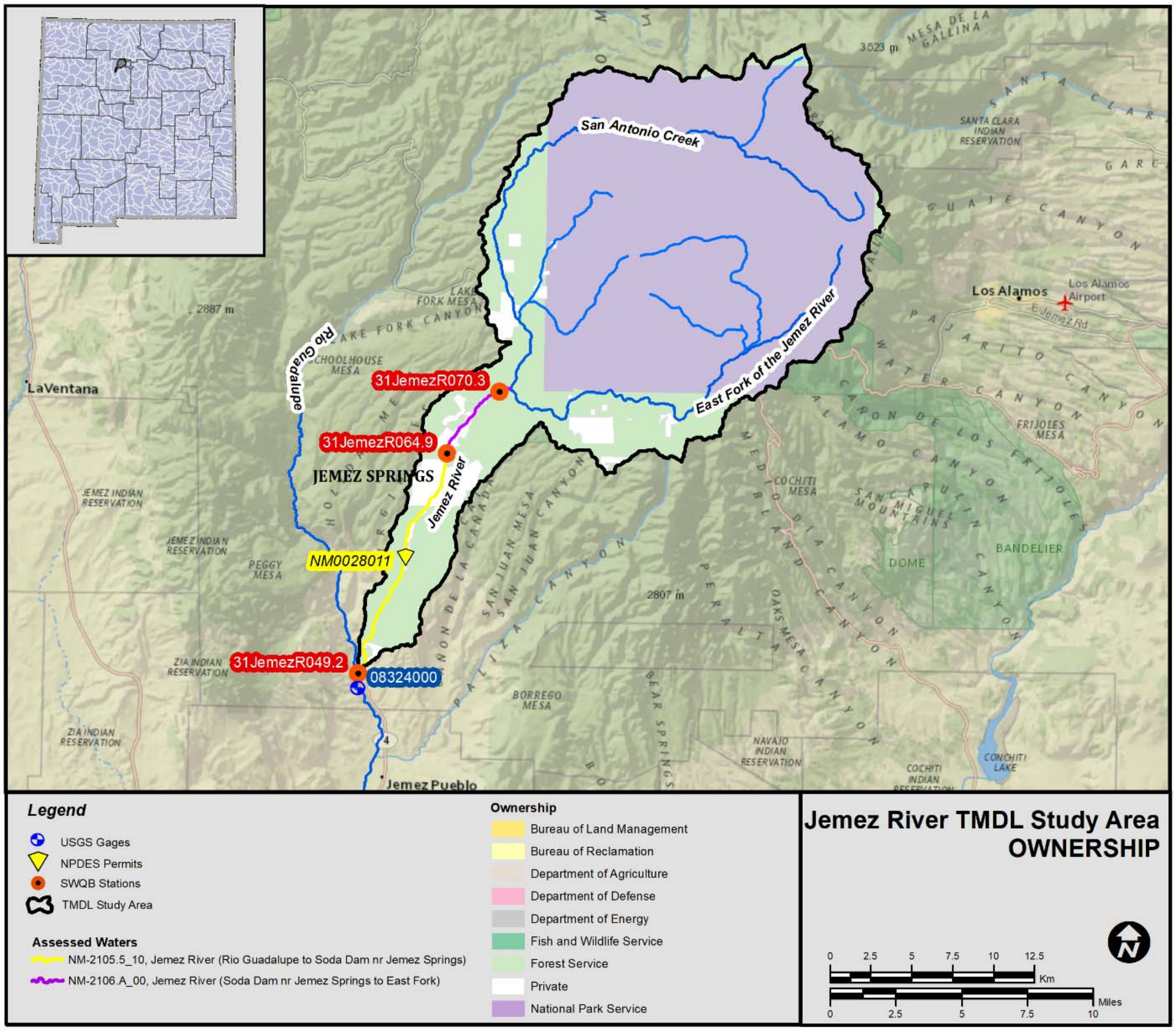


Figure 1.8 Jemez River TMDL Study Area Land Ownership

Two wildfires burned large portions of the Valles Caldera (Figure 1.9), shortly before and during the water sampling events upon which this impairment is based. The Las Conchas fire burned from June 26 to August 3, 2011 and covered a total of 154,349 acres. The Thompson Ridge fire burned from May 31 to July 1, 2013 (during the SWQB water quality survey) and covered a total of 23,965 acres, all within the Valles Caldera. Since that time, an additional fire burned a small area of the watershed just south of the East Fork of the Jemez River. The 1412-acre Cajete fire was active from June 15 to June 24, 2017.

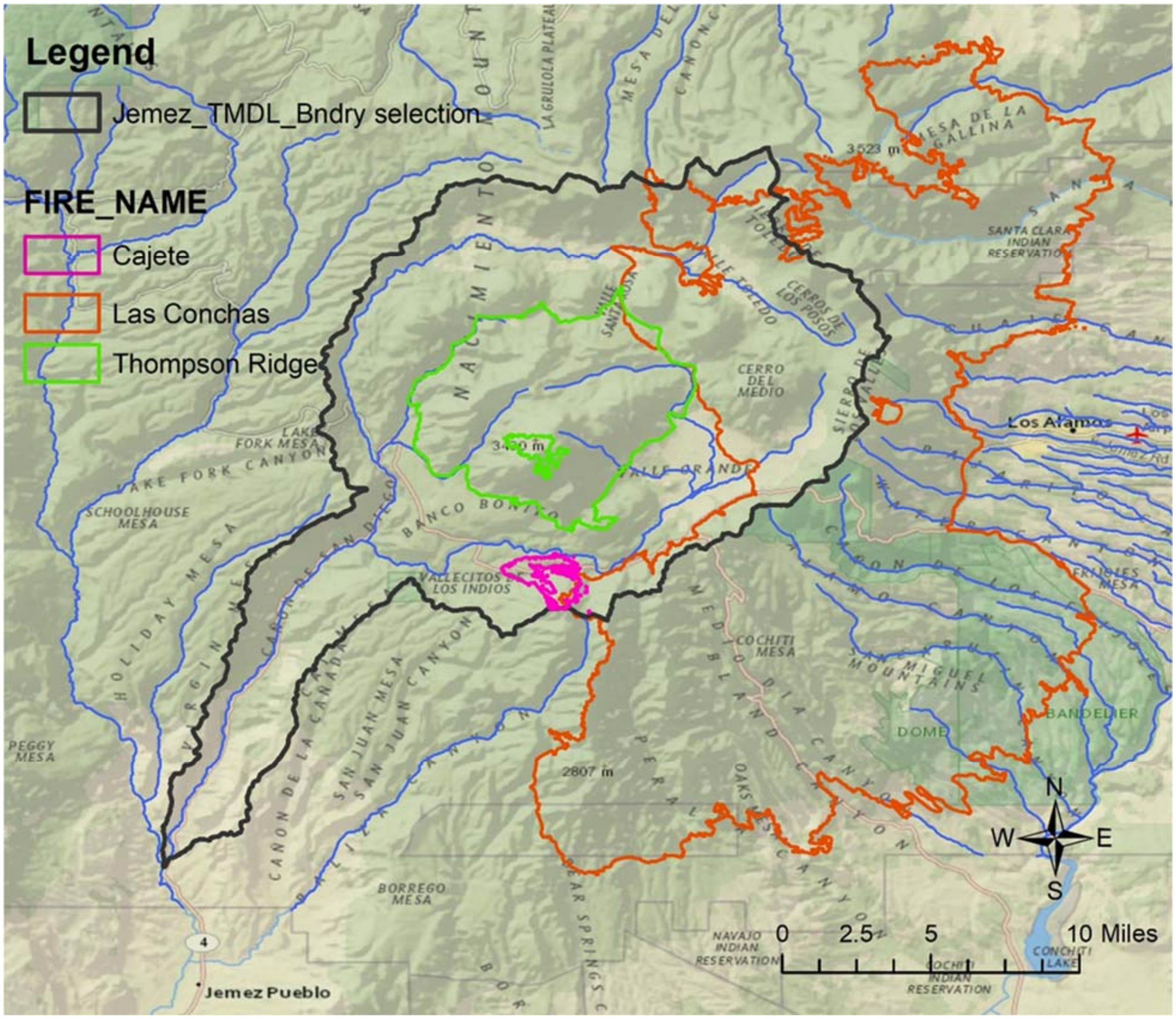


Figure 1.9 Perimeters of the Las Conchas (2011), Thompson Ridge (2013), and Cajete (2017) wildfires.

1.3 Water Quality Standards

The EPA-approved water quality standards (WQS) currently applicable to the Rio Grande TMDL study area are set forth in the following section of *New Mexico Standards for Interstate and Intrastate Surface Waters* (20.6.4 NMAC):

20.6.4.105 RIO GRANDE BASIN - The main stem of the Rio Grande from the headwaters of Elephant Butte reservoir upstream to Alameda bridge (Corrales bridge), excluding waters on Isleta pueblo.

A. Designated Uses: irrigation, marginal warmwater aquatic life, livestock watering, public water supply, wildlife habitat and primary contact.

B. Criteria: (1) The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses. **(2)** At mean monthly flows above 100 cfs, the monthly average concentration for: TDS l,500 mg/L or less, sulfate 500 mg/L or less and chloride 250 mg/L or less.

The EPA-approved water quality standards currently applicable to the Jemez River are set forth in the following sections of *New Mexico Standards for Interstate and Intrastate Surface Waters* (20.6.4 NMAC):

20.6.4.107 RIO GRANDE BASIN - The Jemez river from the Jemez pueblo boundary upstream to Soda dam near the town of Jemez Springs and perennial reaches of Vallecito creek.

A. Designated Uses: coldwater aquatic life, primary contact, irrigation, livestock watering and wildlife habitat; and public water supply on Vallecito creek.

B. Criteria: The use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criterion applies: temperature 25°C (77°F).

20.6.4.108 RIO GRANDE BASIN - Perennial reaches of the Jemez river and all its tributaries above Soda dam near the town of Jemez Springs, except San Gregorio lake and Sulphur creek above its confluence with Redondo creek, and perennial reaches of the Guadalupe river and all its tributaries.

A. Designated Uses: domestic water supply, fish culture, high quality coldwater aquatic life, irrigation, livestock watering, wildlife habitat and primary contact.

B. Criteria: the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criteria apply: specific conductance 400 µS/cm or less (800 µS/cm or less on Sulphur creek); the monthly geometric mean of *E. coli* bacteria 126 cfu/100 mL or less, single sample 235 cfu/100 mL or less; and pH within the range of 2.0 to 8.8 on Sulphur creek.

20.6.4.900 NMAC provides standards applicable to attainable or designated uses unless otherwise specified in 20.6.4.101 through 20.6.4.899 NMAC. 20.6.4.13 NMAC lists general criteria that apply to all surface waters of the state at all times, unless a specified criterion is provided elsewhere in 20.6.4 NMAC.

1.4 Antidegradation and TMDLs

New Mexico's antidegradation policy, which is based on the requirements of 40 C.F.R. 131.12, describes how waters are to be protected from degradation (20.6.4.8.A NMAC). At a minimum, the policy mandates that "the level of water quality necessary to protect the existing uses shall be maintained and protected in all surface waters of the state." Furthermore, the policy's requirements must be met whether or not a segment is impaired. TMDLs are consistent with this policy because implementation of a TMDL restores water quality so that existing uses are protected and water quality criteria are achieved.

The *Antidegradation Policy Implementation Procedure* establishes the process for implementing the antidegradation policy (Appendix A of NMED/SWQB, 2011). However, specific requirements in the *Antidegradation Policy Implementation Procedure* do not apply to the WQCC's establishment of TMDLs because these types of water quality-related actions already are subject to extensive requirements for review and public participation, as well as various limitations on degradation imposed by state and federal law (NMED/SWQB, 2011).

1.5 Field Survey

Rio Grande Study Area

The MRG watershed was sampled by the SWQB in 2014. Surface water quality samples were collected between March and October. Surface water quality monitoring stations were selected to characterize water quality of various assessment units (i.e., stream reaches) throughout the watershed. Stations were established to evaluate the impact of tributary streams and to determine ambient and background water quality conditions. Sampling stations referred to in this report are shown on Figures 1.2 through 1.4 and described on Table 1.1, below. Surface water grab samples were analyzed for a variety of chemical/physical parameters. Data from grab samples and field measurements are housed in the SWQB provisional water quality database and were uploaded to USEPA's Storage and Retrieval (STORET) database. A more detailed description of the MRG survey can be found in *Sampling Summary Middle Rio Grande and Tributaries Water Quality Survey* (NMED/SWQB 2015a).

Jemez River Study Area

The Jemez watershed was sampled by the SWQB in 2013. Surface water quality samples were collected between March and December. Additional samples were obtained in 2015. Surface water quality monitoring stations were selected to characterize water quality of various assessment units (i.e., stream reaches) throughout the watershed. Stations were established to evaluate the impact of tributary streams and to determine ambient and background water quality conditions. Sampling stations referred to in this report are shown on Figures 1.5 through 1.7 and described on Table 1.1. Surface water grab samples were analyzed for a variety of chemical and physical parameters. Data from grab samples and field measurements are housed in the SWQB provisional water quality database and were uploaded to USEPA's Storage and Retrieval (STORET) database. A more detailed description of the Jemez survey can be found in *Sampling Summary Jemez River Watershed Water Quality Survey* (NMED/SWQB 2015b).

Table 1.1 SWQB Monitoring Stations referred to in this report

Station ID	Station Name	Assessment Unit Represented
32RGrand391.9	Rio Grande at US 60 near Bernardo	Rio Grande (Rio Puerco to Isleta Pueblo bnd)
32RGrand342.5	Rio Grande @ Socorro	Rio Grande (Arroyo de las Canas to Rio Puerco)
32RGrand292.8	Rio Grande at USGS gage near San Marcial	Rio Grande (San Marcial at USGS gage to Arroyo de las Canas)
31JemezR070.3	Jemez River at USGS gage blw Battleship Rock	Jemez River (Soda Dam nr Jemez Springs to East Fork)
31JemezR064.9	Jemez River above Soda Dam	Jemez River (Soda Dam nr Jemez Springs to East Fork)
31JemezR049.2	Jemez River above Rio Guadalupe	Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)

1.6 Hydrologic Conditions

Rio Grande Study Area

The samples from the TMDL study area on the Rio Grande that were analyzed for aluminum during the 2014 SWQB survey were taken over a range of flow conditions from March to October. As stated in the Assessment Protocol (NMED/SWQB 2015b), data collected during all flow conditions, including low flow conditions, will be used to determine attainment status of designated or existing uses. In terms of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions, unless the WQS specify a qualifier.

Table 1.2: Active real-time USGS gages on Rio Grande in the TMDL study area

Gage Number	Gage Name	Period of Record
08354900	Rio Grande Floodway at San Acacia, NM	1958-2017
08355050	Rio Grande at Bridge near Escondido, NM	2005-2017
08355490	Rio Grande above US Hwy 380 near San Antonio, NM	2005-2017
08358400	Rio Grande Floodway at San Marcial, NM	1949-2017
08358300	Rio Grande Conveyance Channel at San Marcial, NM [1]	1951-2017

[1] Conveyance channel is managed by U.S. Bureau of Reclamation and is a diversion of the Rio Grande.

As can be seen from daily mean discharge graphed for the survey year (Figures 1.10 through 1.12), 2014 flows were lower than normal from March until mid-July, and near-normal for the rest of the irrigation season. However, there were three storm events (mid-July, early August, and late September) that caused higher than normal flows for a period of days. The San Acacia gage is above the LFCC, the Escondida gage is in the Rio Grande floodway above any return flows, and the San Marcial gage is in the Rio Grande floodway below the majority of return flow from the LFCC.

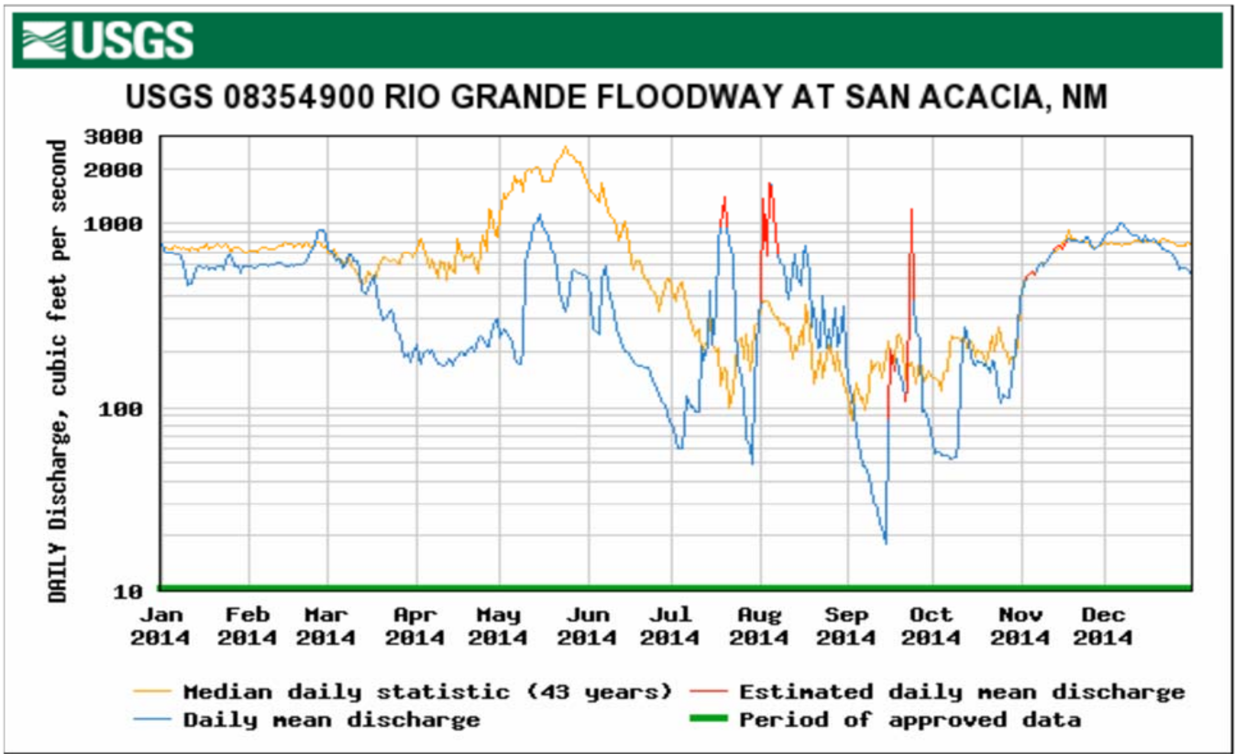


Figure 1.10 2014 Daily Mean Streamflow: USGS 08354900 - Rio Grande at San Acacia. Gage locations are shown on Figures 1.2 through 1.4.

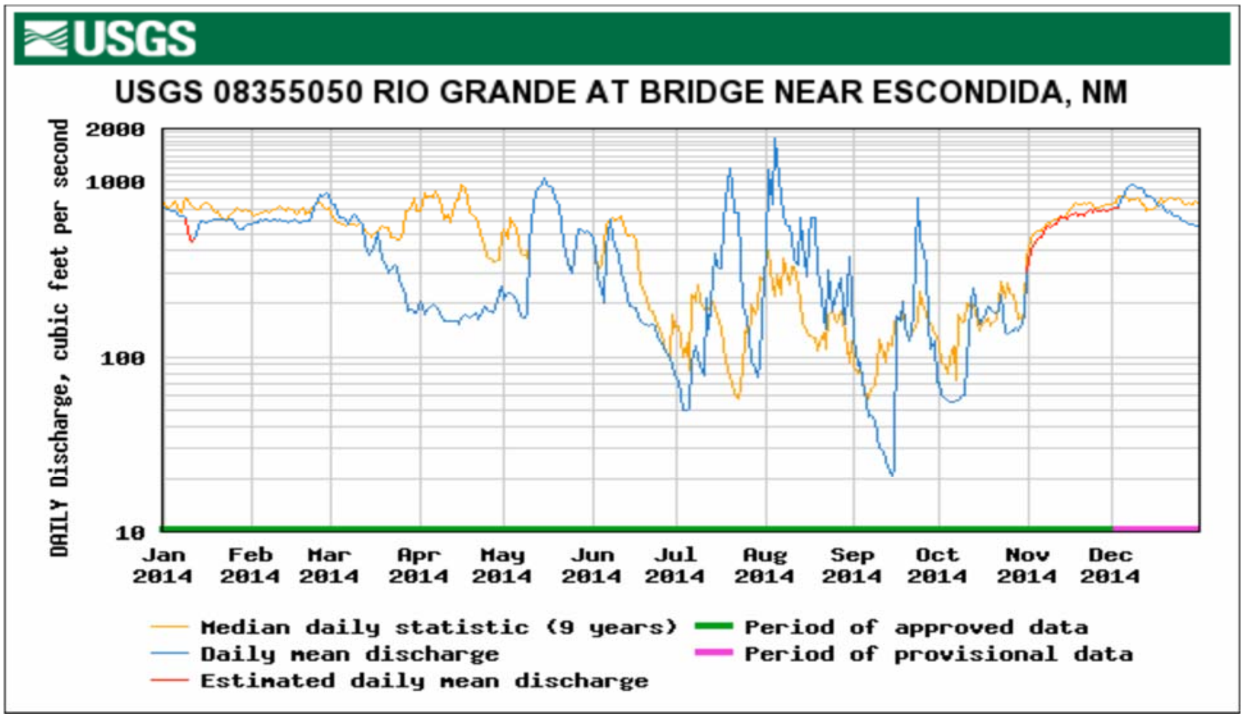


Figure 1.11 2014 Daily Mean Streamflow: USGS 08355050 - Rio Grande near Escondida. Gage locations are shown on Figures 1.2 through 1.4.

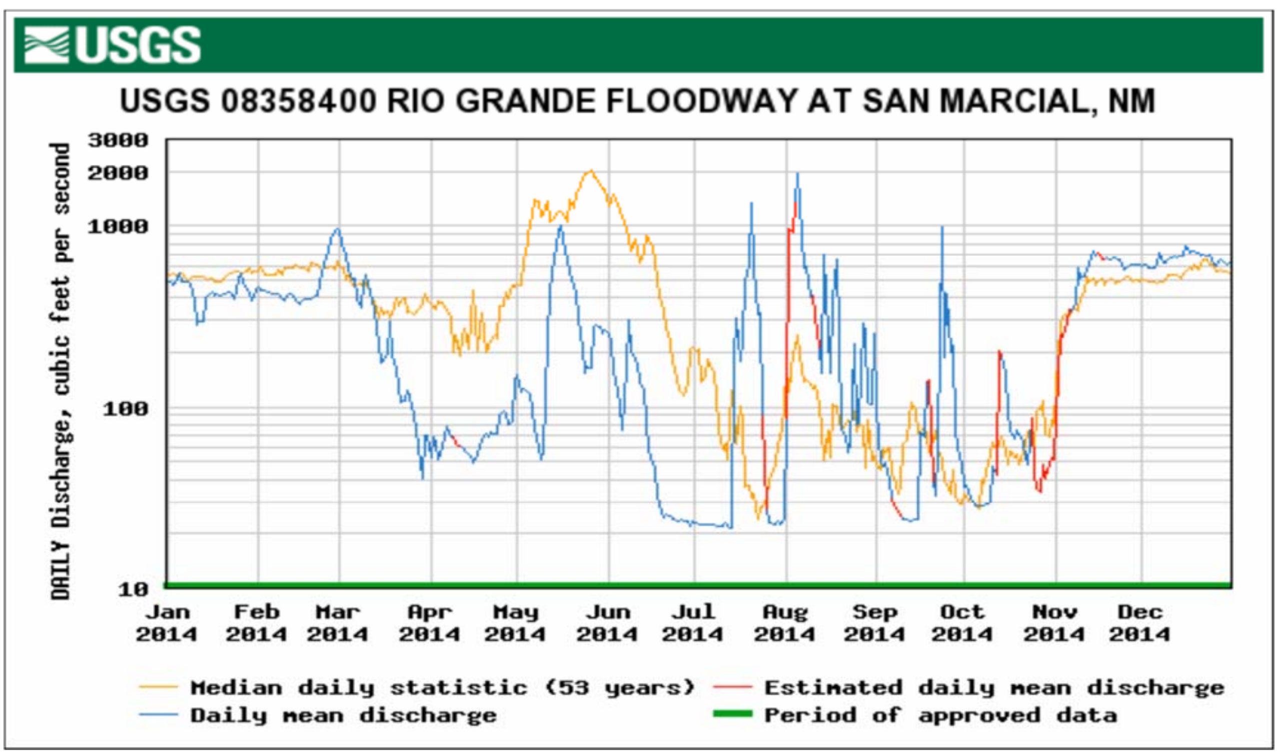


Figure 1.12 2014 Daily Mean Streamflow: USGS 08358400 - Rio Grande at San Marcial. Gage locations are shown on Figures 1.2 through 1.4.

Jemez River Study Area

The samples from the Jemez River that were analyzed for aluminum during the 2013 SWQB survey, and additional 2015 samples that were also assessed, were taken over a range of flow conditions from March to December of 2013 and in August, 2015. As stated in the Assessment Protocol (NMED/SWQB 2015b), data collected during all flow conditions, including low flow conditions, will be used to determine attainment status of designated or existing uses. In terms of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions, unless the WQS specify a qualifier.

As can be seen from daily mean discharge graphed for the survey years (Figures 1.13 and 1.14), 2013 flows were lower than normal for most of the year. However, there were storm events in late July and most of September (after the sampling event) that caused higher than normal flows. Flow was near normal at the time of the August 2015 sampling event. The Jemez River near Jemez gage is below the confluence with the Rio Guadalupe, and so does not reflect actual flow in the TMDL AUs (where there is no active gage). Figures 1.13 and 1.14 are presented for the purpose of comparing the survey years to historic average flows in the Jemez headwaters region.

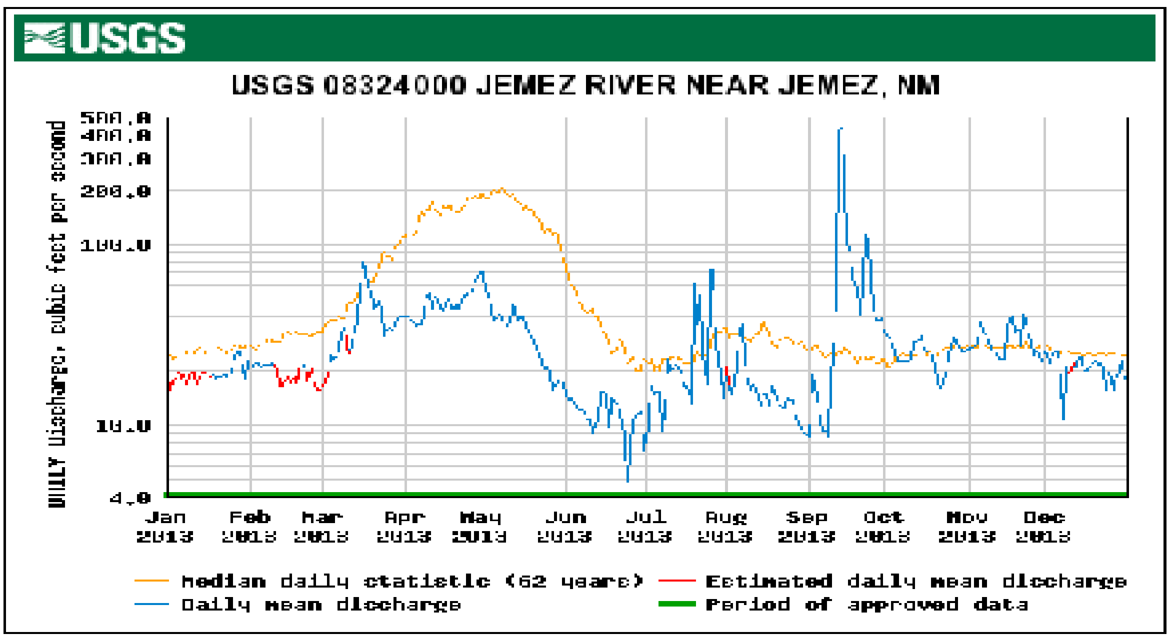


Figure 1.13 2013 Daily Mean Streamflow: USGS 08324000 – Jemez River Near Jemez, NM. Gage location is shown on Figures 1.5 through 1.7.

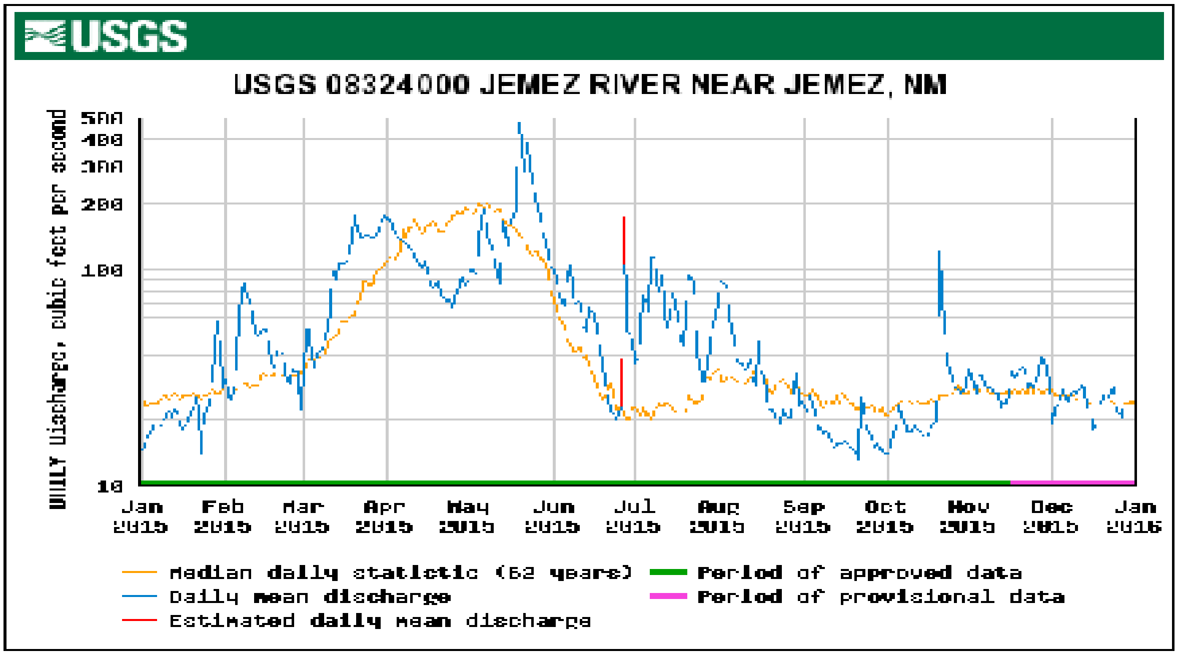


Figure 1.14 2015 Daily Mean Streamflow: USGS 08324000 – Jemez River Near Jemez, NM. Gage location is shown on Figures 1.5 through 1.7.

2.0 ALUMINUM TMDL

Chronic high levels of aluminum can be toxic to fish, benthic invertebrates, and some single-celled plants. Aluminum concentrations from 0.1 to 0.3 mg/L (100 to 300 ug/L) increase mortality and retard growth, gonadal development, and egg production of fish. Information on the toxic forms of aluminum in natural waters suggest that soluble trivalent aluminum (Al^{3+}) exerts a toxic effect on fish by binding to the negative charge of gill tissues, thereby disrupting ionoregulatory and respiratory balance (Exley et al., 1991; Gensemer and Playle, 1999). This charge interaction is complicated by subsequent polymerization of insoluble, positive-charged Al oxyhydroxides to fish gill tissues and thus both soluble and insoluble forms are implicated in the toxic response of fish to Al (Gensemer and Playle, 1999).

2.1 Target Loading Capacity

In 2010, the WQCC approved a change of the water quality standard from dissolved aluminum to hardness-dependent total recoverable aluminum (TR Al). In 2012, USEPA approved the change for use in waters where the pH is between 6.5 and 9. Waters of the Middle Rio Grande and Jemez River TMDL study areas were within the applicable pH range during all of the 2013, 2014 and 2015 sampling events. The term “total recoverable” refers to the analytical method used in laboratory analysis, and is essentially interchangeable with the term “total”. “Total recoverable” is used here to reflect the language in 20.6.4.900.I NMAC, specifically, “For aluminum, the criteria are based on analysis of total recoverable aluminum in a sample that is filtered to minimize the mineral phase as specified by the department.” Based on recommendations from an aluminum filtration study conducted by SWQB staff (NMED/SWQB, 2012), if the turbidity exceeds 30 NTU, samples that will be analyzed for TR Al are filtered using a filter of 10 µm pore size that minimizes mineral-phase aluminum without restricting amorphous or colloidal phases. To be conservative, the TMDLs are calculated to protect against exceedance of the chronic criterion, which is more stringent than the acute criterion.

Table 2.1 Exceedences of the Hardness-based Total Recoverable Al WQS

Assessment Unit	WQS Segment	Exceedence Ratio
Rio Grande (Arroyo de las Canas to Rio Puerco)	20.6.4.105	2/4 chronic 2/4 acute
Rio Grande (San Marcial at USGS gage to Arroyo de las Canas)	20.6.4.105	2/5 chronic 2/5 acute
Jemez River (Soda Dam nr Jemez Springs to East Fork)	20.6.4.108	4/5 chronic 3/5 acute
Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	20.6.4.107	2/4 chronic 1/4 acute

To meet aquatic life designated uses, the SWQB Assessment Protocol (NMED SWQB, 2015b) says that for any one chemical/physical pollutant, there shall be no more than one exceedence of the acute criterion, and no more than one exceedance of the chronic criterion in three years. Exceedences of the WQS were identified by assessment of the data from the 2014 SWQB Middle Rio Grande and the 2013 SWQB Jemez River Watershed intensive water quality surveys, and 2015 supplemental sampling, as shown on Table 2.1. Consequently, these AUs were listed on the 2016-2018 Integrated CWA §303(d)/§305(b) List (NMED/SWQB, 2016b) for aluminum. Results of laboratory analyses of the samples are shown in Appendix A.

2.2 Flow

Rio Grande Study Area

SWQB is taking a watershed approach to this revised TMDL to account for upstream contributing areas. This type of approach allows for calculation of a watershed-wide TMDL and better accounting of the incoming nutrient loads and allowable loading in the impaired sub-watersheds. By using this approach, point and nonpoint sources throughout the watershed are accounted for and can be appropriately targeted through the implementation process. Additional information about reasonable assurance is included in Section 3.0.

The TMDL is a value calculated at a defined critical flow condition as part of a planning process to achieve water quality standards. Since flows vary throughout the year in these systems, the actual load at any given time will vary based on the changing flow. Therefore, the TR Al loading target for the Rio Grande AUs is evaluated using a flow duration curve, which looks at the cumulative frequency of historic flow data over a specified period. A flow duration curve relates flow values to the percent of time those values have been met or exceeded. The use of "*percent* *of time"* provides a uniform scale ranging between 0 and 100. Thus, the full range of stream flows is considered. Low flows are exceeded a majority of the time, while floods are exceeded infrequently (USEPA, 2007).

A basic flow duration curve runs from high to low along the x-axis. The x-axis represents the duration, or percent of time, as in a cumulative frequency distribution. The y-axis represents the flow value (e.g., cubic feet per second) associated with that percent of time, or duration. The flow duration analysis presented here uses daily average discharge rates, which are sorted from the highest value to the lowest (Figures 2.1). Using this convention, flow duration intervals are expressed as a percentage, with zero corresponding to the highest stream discharge in the record (i.e., flood conditions) and 100 to the lowest (i.e., drought conditions). Thus, a flow duration interval of sixty associated with a specific stream discharge implies that sixty percent of all observed daily average stream discharge values equal or exceed that discharge value.

Data from the Rio Grande Floodway at San Marcial gage (USGS 08358400) were used to generate a flow duration curve for the combined Rio Grande (San Marcial at USGS gage to Arroyo de las Canas) and Rio Grande (Arroyo de las Canas to Rio Puerco) AUs. Gage locations are shown on Figures 1.2 through 1.4. Impoundment of Rio Grande water in Cochiti Reservoir began in 1973. The flow regime of the Rio Grande changed significantly following the construction of this reservoir; therefore, flow data available before 1974 were not used in this analysis. Design flow from the one permitted point source (the Socorro WWTP) was not added because it is already included in actual flow as measured at the gage.

Duration curve analysis may include the identification of intervals which can be used as a general indicator of hydrologic condition (i.e., wet versus dry and to what degree). Flow duration curve intervals can be grouped into broad categories or zones in order to provide additional insight about conditions and patterns associated with the impairment. In this case we have divided the curve into five zones, as illustrated in Figures 2.1 and 2.2: one representing *high flows (0-10%)*, another for *moist conditions (10-40%)*, one covering *mid-range flows (40-60%)*, another for *dry conditions (60-90%)*, and one representing *low (or no) flows (90-100%)* (Cleland 2003). This particular approach places the midpoints of the moist, mid-range, and dry zones at the 25^{th}, 50^{th}, and 75^{th} percentiles respectively (i.e., the quartiles). The high zone is centered at the 5^{th} percentile, while the low zone is centered at the 95^{th} percentile.

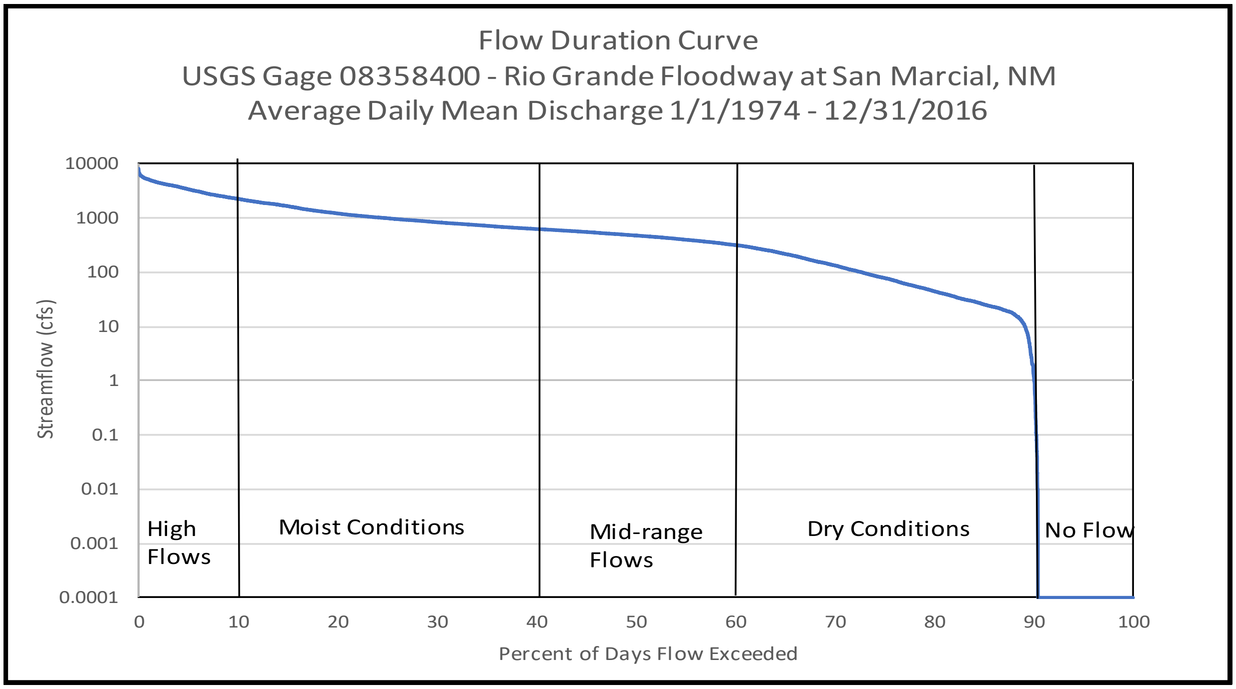


Figure 2.1 Flow Duration Curve for the Rio Grande from the Rio Puerco to the USGS Gage at San Marcial

Jemez River Study Area

A somewhat different watershed approach is taken for the Jemez River study area, because the water quality and flow are significantly different between the two AUs. Approximately 0.88 cfs of flow enters the river at the AU break from Soda Dam and associated thermal springs in the vicinity of the village of Jemez Springs (Reid et al, 2003). Total hardness and pH are both elevated in the lower AU as compared to above the springs. Because the aluminum WQS is hardness-based, the target loads would not be similar (see Appendix A, Table A.2).

The critical flow value used to calculate the TMDLs was the 4Q3, which is the annual lowest four consecutive day flow that occurs with a frequency of at least once every three years. Because the Jemez River is ungaged above the Rio Guadalupe, a regression model developed by Waltemeyer (2002) was used to estimate the critical low flow. In Waltemeyer's analysis, two equations for estimating 4Q3 were developed based on physiographic regions of NM (i.e., statewide and mountainous regions above 7,500 ft in elevation). The average elevation of the Jemez River TMDL watershed is above 7,500 ft, so the mountainous regions regression equation was used. The following mountainous regions regression equation (Equation 2.1) is based on data from 40 gaging stations located above 7,500 ft in elevation with non-zero discharge (Waltemeyer 2002):

Equation 2.1 $$4Q3 = 7.3287 \times 10^{-5} DA^{0.70} {P_w}^{3.58} S^{1.35}$$

Where: 4Q3 = Four-day, three-year low-flow frequency (cfs)
DA = Drainage area (mi^2)
P_w = Average basin mean winter precipitation (inches)
S = Average basin slope (ft/ft)

Parameters used in the calculation were determined using StreamStats, an online USGS GIS application. The values thus obtained were 201 mi^2 drainage area, 11.9 in. mean winter precipitation, and 0.24 ft/ft average basin slope, resulting in a calculated 4Q3 value of 3.10 cfs. The total flow was then divided between the two AUs proportional to drainage area, as shown on Table 2.2. The hot spring complex in the vicinity of Jemez Springs, at the top of the Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs) AU, discharges approximately 0.88 cfs to the river (Reid et al, 2003). Since this flow is not likely to vary much seasonally or in response to precipitation, it has been added to the 4Q3 for the lower AU. In addition, the design flow of 0.12 cfs from the one permitted point source (the Jemez Springs WWTP) has been added to the lower AU critical flow value. Units were converted from cubic feet per second (cfs) to million gallons per day (MGD) for use in calculating the TMDL.

It is important to remember that the TMDL itself is a value calculated at a defined critical condition as part of a planning process designed to achieve water quality standards. Since flows vary throughout the year in these systems, the actual load at any given time will vary based on the changing flow. Management of the load to improve stream water quality is the goal.

Table 2.2 Calculated critical flow for the Jemez River TMDL AUs

Assessment Unit	Calculated Proportional 4Q3 (cfs)	Critical flow (cfs)	Critical flow (MGD)
Jemez River (Soda Dam nr Jemez Springs to East Fork)	0.89	0.89	0.58
Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	2.21	3.21	2.07

2.3 Load Calculations

Rio Grande Study Area

The use of duration curves provides a technical framework for identifying daily loads in TMDL development, which accounts for the variable nature of water quality associated with different stream flow rates. Specifically, a maximum daily concentration limit can be used with basic hydrology and a duration curve to identify a TMDL that covers the full range of flow conditions. With this approach, ambient water quality data, taken with some measure or estimate of flow at the time of sampling, can be used to compute an instantaneous load. Using the relative percent exceedence from the flow duration curve that corresponds to the stream discharge at the time the water quality sample was taken, the computed load can be plotted in a duration curve format (Figure 2.2).

By displaying instantaneous loads calculated from ambient water quality data and the daily average flow on the date of the sample (expressed as a flow duration curve interval), a pattern develops which describes the characteristics of the water quality impairment. Loads that plot above the curve indicate an exceedence of the water quality criterion (chronic dissolved aluminum in this case), while those below the load duration curve show compliance. The pattern of impairment can be examined to see if it occurs across all flow conditions, corresponds strictly to high flow events, or conversely, only to low flows. Impairments observed in the low flow zone typically indicate the influence of point sources, while those further left generally reflect probable nonpoint source contributions. This concept is illustrated in Figure 2.2, using the chronic aluminum criterion calculated at the average hardness value that was measured during the 2014 survey.

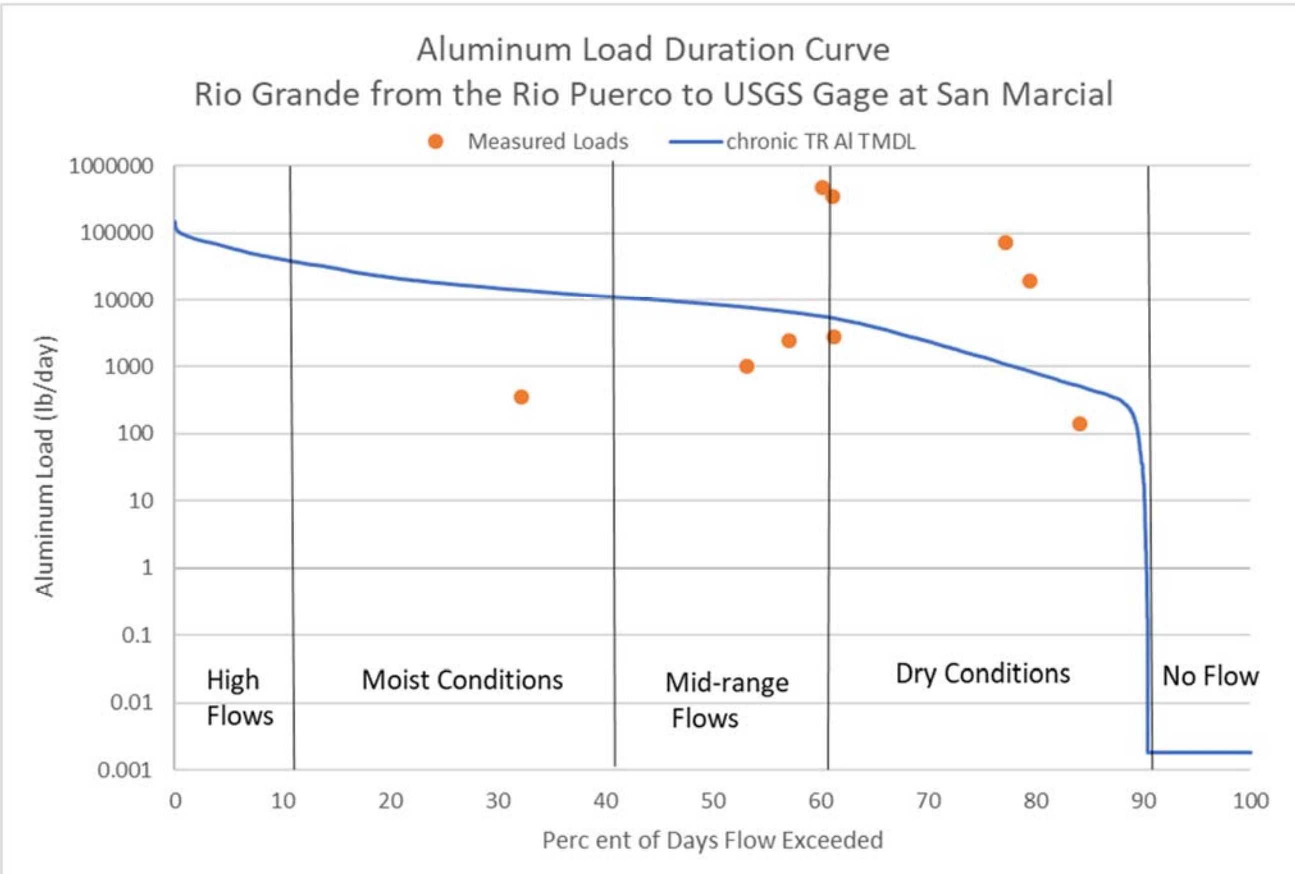


Figure 2.2 Aluminum Load Duration Curve – Rio Grande from USGS Gage at San Marcial to Rio Puerco

Under the duration curve framework, the loading capacity is essentially the curve itself. The loading capacity, which sets the target load on any given day, is determined by the flow on the particular day of interest. However, a continuous curve that represents the loading capacity has some logistical drawbacks. It is often easier to communicate information with a set of fixed targets. Critical points along the curve can be used as an alternative method to quantify the loading capacity, such as the mid-point of each hydrologic zone (e.g., the 5th, 25th, 50th, 75th, and 95th percentiles). A unique loading capacity for each hydrologic zone allows the TMDL to reflect changes in dominant watershed processes that may occur under different flow regimes. The 2010 dissolved aluminum TMDL presented values for the dry and high flow zones, since those were the prevailing conditions at the time that exceedences were documented. Monitoring of the Rio Grande in 2014 documented exceedences during flows in the mid-range and dry zones. Since aluminum exceedences have occurred at a wide range of flow levels in the TMDL study area, TMDL values are presented on Table 2.2 for all hydrologic zones except no flow.

The critical flow was converted from cfs to million gallons per day (MGD) using a conversion factor of 0.646. The target loading capacity is calculated using the following equation: WQS criterion x Flow x 8.34 (a unit conversion factor).

Table 2. 3 Calculation of Target Loads: Rio Grande from USGS Gage at San Marcial to Rio Puerco

	FLOW CONDITIONS				
	High	**Moist**	**Mid-Range**	**Dry**	**No Flow***(a)*
Chronic total recoverable aluminum criterion (mg/l)	3.30	3.30	3.30	3.30	-
Mid-point Flow (MGD)	2178	637	306	50	-
Conversion Factor	8.34	8.34	8.34	8.34	-
TMDL (lb/day)	**59,943**	**17,532**	**8422**	**1376**	**-**

(a) There are no TMDL calculations for No flow conditions because water quality samples could not be obtained

Jemez River Study Area

Exceedences of the TR Al WQS on the Jemez River were documented at moderate flows (from 8 to 23 cfs); the TMDL is presented on Table 2.4 for the critical low flow condition. Chronic aluminum criteria were calculated at the average hardness value that was measured during survey sampling events that resulted in exceedences of the WQS.

Table 2.4 Calculation of Target Loads: Jemez River from East Fork to the Rio Guadalupe

Assessment Unit	Chronic TR Al criterion (mg/l)	Flow (MGD)	Conversion Factor	TMDL (lb/day)
Jemez River (Soda Dam nr Jemez Springs to East Fork)	1.66	0.58	8.34	8.03
Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	0.68	2.07	8.34	11.74

The TMDL is a planning tool to be used to achieve water quality standards. Since flows vary throughout the year in these systems the target load will vary based on the changing flow.

Management of the load to improve stream water quality and meet water quality criteria should be a goal to be attained. The target load (TMDL) is further allocated to a MOS, WLA (permitted point sources), and LA (non-point sources), according to the formula:

$$WLA + LA + MOS = TMDL$$

2.4 Margin of Safety

The CWA requires that each TMDL be calculated with a MOS. This statutory requirement that TMDLs incorporate a MOS is intended to account for uncertainty in available data or in the actual effect controls will have on loading reductions and receiving water quality. A MOS may be expressed as unallocated assimilative capacity or conservative analytical assumptions used in establishing the TMDL (e.g., derivation of numeric targets, modeling assumptions or effectiveness of proposed management actions). The MOS may be implicit, utilizing conservative assumptions for calculation of the loading capacity, WLAs, and LAs. The MOS may also be explicitly stated as an added separate quantity in the TMDL calculation. For these aluminum TMDLs, the MOS was developed using a combination of conservative assumptions and explicit allocations. Therefore, this MOS is the sum of the following two elements:

- *Implicit Margin of Safety*

Treating aluminum as a pollutant that does not readily degrade in the environment, was used as a conservative assumption in developing these loading limits. The TMDL was calculated to meet the more conservative chronic WQS rather than the acute aluminum standard.

- *Explicit Margin of Safety*

An explicit MOS identified using a duration curve framework is basically unallocated assimilative capacity intended to account for uncertainty (e.g., loads from tributary streams, effectiveness of controls, etc.). As new information becomes available, this unallocated capacity may be attributed to nonpoint sources including tributary streams (which could then be added to the load allocation); or it may be attributed to point sources (and become part of the waste load allocations).

An explicit MOS of 15% was assigned to the Rio Grande AUs in the TMDL study area: 10% to account for the inherent error in all flow measurements, plus another 5% due to the complexity of flow engineering in the reach. An explicit MOS of 10% was assigned to each Jemez River AU in the TMDL study area, to account for the inherent error in all flow measurements.

2.5 Waste Load Allocation

<u>Rio Grande Study Area</u>

There is one NPDES permitted discharge in the Rio Grande (Arroyo de las Canas to Rio Puerco) AU. The City of Socorro Wastewater Treatment Plant (WWTP) (NM0028835, expires February

28, 2021) discharges into the Luis Lopez Drain, thence to Socorro Riverside Drain, thence to the Rio Grande in WQS Segment 20.6.4.105. The City of Socorro WWTP is an intermittent cycle extended aeration system. This sequencing batch reactor system works in steps to biologically degrade the influent. Influent flows into the pre-react zone, which is aerated and serves as both a biological adsorption and microorganism selector zone. The reaction basin operates sequentially as an aeration basin, sedimentation basin and decantation basin. There are three basins available at this facility for treatment. Alum (potassium aluminum sulfate) is a coagulant used to clarify drinking water and wastewater, and can be a source of aluminum if water is discharged to aquatic systems (USEPA, 2017); however, this facility does not use alum in their process. The NPDES permit has limits of 87 ug/l daily maximum and 0.943 lb/day as a 7-day average for total aluminum (dissolved aluminum is a reporting requirement, but does not have a permitted limit). The facility did not report any exceedences of permit limits or spikes in aluminum values during the summer of 2014.

The 2010 TMDL document presented WLA values for dissolved aluminum. A WLA will be assigned based on design flow and the chronic water quality standard for total recoverable aluminum from 20.6.4.900 NMAC at the average hardness value recorded for samples during the water quality survey. The current permit has a design flow of 1.3 MGD. The WLA is calculated using the following equation: WQS criterion x Design Flow x 8.34 (a unit conversion factor). SWQB anticipates the facility will monitor both dissolved and total aluminum in order to produce a relationship between the two constituents.

One additional NPDES permit was in effect at the time that the previous aluminum TMDL for this reach was completed. The New Mexico Firefighters Training Academy (NM0029726) discharged into Dry Arroyo, then a Diversion Channel, and finally to the Rio Grande in WQS Segment 20.6.4.105. The permit expired June 30, 2014 and was not renewed. NM0029726 did not have a permit limit for aluminum. However, according to the draft permit from EPA R6, "because analytical result of aluminum was not reported with the 2004 application, a monitoring requirement of dissolved aluminum is established." On-site lagoons were drained of approximately 1.3 million gallons at 3 to 5-year intervals to allow for silt removal. Dissolved aluminum samples collected from the ponds in April 2009 showed maximum results of 0.022 mg/L. No WLA will be assigned to this permit which is no longer in effect. There are no NPDES permitted discharges in the Rio Grande (San Marcial at USGS gage to Arroyo de las Canas) AU. Therefore, the WLA will be zero.

The <u>Procedures for Implementing National Pollutant Discharge Elimination System Permits in New Mexico</u> (2012) states:

> *"Monitoring requirements in permits can be expressed in the dissolved form, but limitations must be expressed in the total recoverable form, per the requirements of 40 CFR 122.45(c). When a limitation is required, or when the only effluent or ambient data available is in the total recoverable form, a 1:1 conversion to the dissolved form will be made for water quality screens. The reverse process will be made to obtain a limitation in the total recoverable form. During the permit development or the public participation process of the permit, the permittee shall*

be allowed the opportunity to submit data in the dissolved form for a water quality screening directly with numeric criteria in the proper form."

Jemez River Study Area

The Village of Jemez Springs Wastewater Treatment Plant (NM0028011) is the only NPDES permitted discharge to the Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs) AU. The current permit issued by EPA became effective March 1, 2016 and expires February 28, 2021. The facility discharges directly into the Jemez River, in Water Quality Standards Segment 20.6.4.107. The treatment system is a sequencing batch reactor with tertiary treatment using chemical addition of ferric chloride for the removal of phosphorous, a plant nutrient. The Village of Jemez Springs never used alum in their treatment process. When the plant was built and the tertiary treatment process was evaluated, the Village's engineering consultant conducted a series of tests to optimize the use of ferric chloride for phosphorous reduction instead of using alum. The WWTP currently is operated with ferric chloride.

The current permit has a design flow of 0.075 MGD for the facility, though most pollutant loads in the permit have been calculated using an earlier design flow of 0.045 MGD because of the State's antidegradation concerns. The current permit does not include a discharge limit or monitoring for aluminum. The WLA will be calculated based on the design flow of 0.075 MGD and the chronic water quality standard for total recoverable aluminum from 20.6.4.900 NMAC at the average hardness value for samples taken during the water quality survey, using the following equation: WQS criterion x Design Flow x 8.34 (a unit conversion factor). There are no NPDES permitted discharges in the Jemez River (Soda Dam nr Jemez Springs to East Fork) AU. Therefore the WLA will be zero.

There are no Municipal Separate Storm Sewer System (MS4) storm water permits in the TMDL study area. Sediment may be a component of some industrial and construction storm water discharges covered under General NPDES Permits, so the load from these discharges should be addressed. In contrast to discharges from other industrial storm water and individual process wastewater permitted facilities, storm water discharges from construction activities are transient because they occur mainly during the construction itself, and then only during storm events. Coverage under the NPDES construction general storm water permit (CGP) for construction sites greater than one acre requires preparation of a Storm Water Pollution Prevention Plan (SWPPP) that includes identification and control of all pollutants associated with the construction activities to minimize impacts to water quality. In addition, the current CGP also includes state specific requirements that the SWPPP must include site-specific interim and permanent stabilization, managerial, and structural solids, erosion, and sediment control best management practices (BMPs) and/or other controls that are designed to prevent to the maximum extent practicable an increase in the sediment yield and flow velocity from preconstruction, pre-development conditions to assure that applicable standards in 20.6.4 NMAC, including the antidegradation policy, or WLAs are met. In this case, compliance with a SWPPP that meets the requirements of the CGP is generally assumed to be consistent with this TMDL.

Other industrial storm water facilities are generally covered under the current NPDES Multi-Sector General Storm Water Permit (MSGP). This permit also requires preparation of an SWPPP that includes identification and control of all pollutants associated with the industrial activities to minimize impacts to water quality. In this case, compliance with a SWPPP that meets the requirements of the MSGP is generally assumed to be consistent with this TMDL. Individual wasteload allocations for the General Permits were not possible to calculate at this time in this watershed using available tools. Loads that comply with the General Permits from facilities covered are therefore currently calculated as part of the watershed Load Allocation.

2.6 Load Allocation

In order to calculate the LA, the WLA and the MOS were subtracted from the target capacity (TMDL), as shown on Tables 2.5 and 2.6. The MOS was developed using a combination of conservative assumptions and explicit recognition of potential errors (see Section 2.4 for details).

Table 2.5 TMDL Allocations (lb/day) for Total Recoverable Aluminum: Rio Grande from USGS Gage at San Marcial to Rio Puerco

Flow Condition	TMDL	MOS	LA	WLA
High	59,943	8991	50,917	34.9
Moist	17,532	2630	14,867	34.9
Mid-Range	8422	1263	7124	34.9
Dry	1376	206	1135	34.9
No Flow[(a)]	-	-	-	-

a) TMDL cannot be calculated for No flow conditions

Table 2.6 TMDL Allocations (lb/day) for Total Recoverable Aluminum: Jemez River from the East Fork to Rio Guadalupe

Assessment Unit	TMDL	MOS	LA	WLA
Jemez River (Soda Dam nr Jemez Springs to East Fork)	8.03	0.8	7.23	0
Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	11.74	1.17	9.54	1.03

The extensive data collection and analyses necessary to determine background aluminum loads were beyond the resources available for this study. It is therefore assumed that a portion of the load allocation is made up of natural background loads.

2.7 Probable Pollutant Source(s)

SWQB fieldwork includes an assessment of the probable sources of impairment in the AU drainage area (Appendix B). Probable Source Sheets are filled out by SWQB staff during watershed surveys and watershed restoration activities. The list of probable sources is intended to provide information on the potential sources of impairment and does not single out any particular land owner or land management activity, or imply a magnitude or relative importance of any specific source. The list generally includes several sources per pollutant. Tables 2.7 and 2.8 display probable pollutant sources that have the potential to contribute to aluminum impairment within each AU in the TMDL study areas, as determined by field reconnaissance and knowledge of watershed activities. The draft probable source list will be reviewed and modified, as necessary, with watershed group/stakeholder input during the TMDL public meeting and comment period. Probable sources of impairment will be further evaluated, refined, and changed as necessary through the Watershed-Based Plan (WBP).

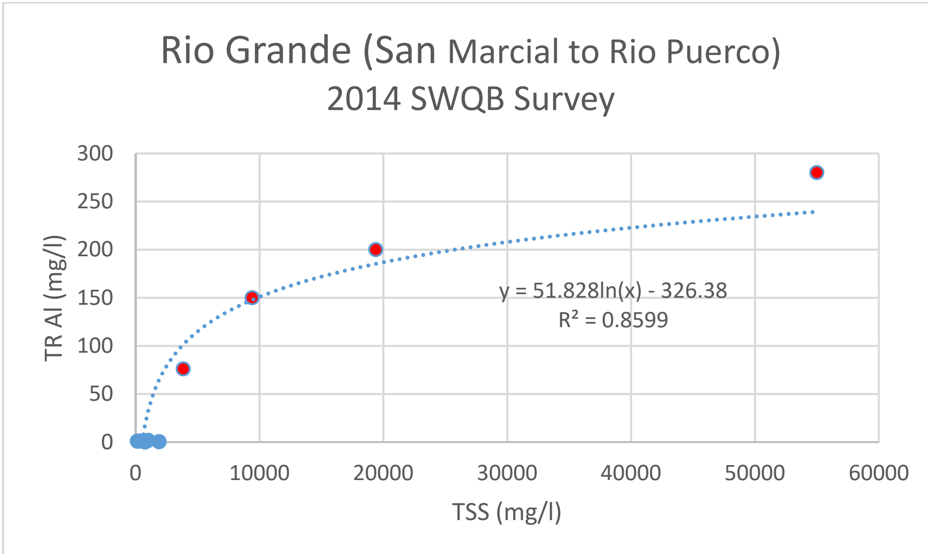
Table 2.7 Probable source summary for total recoverable aluminum – Middle Rio Grande TMDL study area

NM-2105_11 Rio Grande (Arroyo de las Canas to Rio Puerco)	
Dams/diversions	Irrigated crop production
Residences/buildings	Exotic species
Rangeland grazing	Waterfowl
Channelization	Riprap/ Wall/Dike/Jetty Jack
NM-2105_10 Rio Grande (San Marcial at USGS Gage to Arroyo de las Canas)	
Channelization	Irrigated crop production
Dams/diversions	Exotic species
Active exotics removal	Waterfowl
Rangeland grazing	Forest fire runoff
Riprap/ Wall/Dike/Jetty Jack	

Table 2.8 Probable source summary for total recoverable aluminum – Jemez River TMDL study area

NM-2106.A_00 Jemez River (Soda Dam nr Jemez Springs to East Fork)	
Pavement/ Impervious surface	Residences/ Buildings
Logging Operations – Legacy	Paved Roads
Gravel or Dirt Roads	Rangeland Grazing
Angling Pressure	Watershed Runoff following Forest Fire
NM-22105.5.A_10 Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)	
Pavement/ Impervious surface	Residences/ Buildings
Site Clearance/ Land Development	Rangeland Grazing
Bridges/ Culverts/ RR Crossings	Paved Roads
Gravel or Dirt Roads	Irrigated Crop Production
Angling Pressure	Campgrounds
Watershed Runoff following Forest Fire	

In general, increased metals in the water column can commonly be linked to sediment transport and accumulation, where the metals are a constituent part of the stream. This does appear to be the case for the TMDL study areas, as evidenced by the strong relationship between the total recoverable aluminum and total suspended solids (TSS) concentrations (Figure 2.3). The relationship is further borne out by results of the July 16, 2014, water quality sampling event at the Rio Grande monitoring station just above the Rio Puerco (Rio Grande at US 60 near Bernardo, location shown on Figures 1.2 through 1.4). The total recoverable aluminum concentration was 19 mg/l while TSS was 3080 mg/l, a data point which would sit close to the curve depicted in Figure 2.5. On that same day, TSS at the USGS gage at San Marcial was 19,400 mg/l, indicating a massive injection of sediment to the TMDL AUs. The New Mexico Office of the State Engineer (2004) reports that annual sediment delivery from the Rio Puerco averages 4.44 million tons, which is equivalent to 12,000 tons per day.



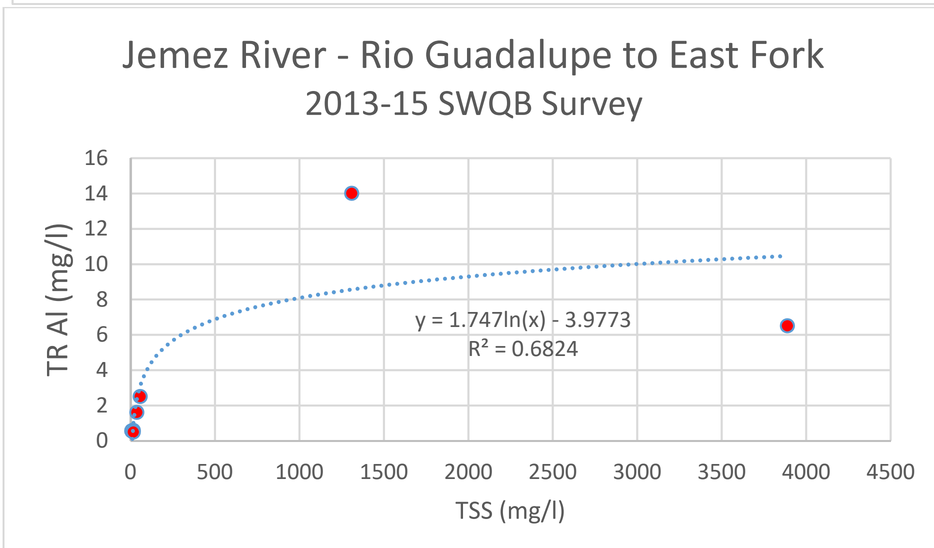


Figure 2.3 Relationship between total recoverable aluminum and TSS. Points colored red mark exceedences of the aluminum WQS.

The Rio Puerco enters the Rio Grande just south of Bernardo, NM. The reach of the Rio Puerco from the Rio Grande to Cuba, NM, flows through a complex mixture of private, State, and Federal lands in a wide, deeply incised, vertical-walled canyon with banks up to 10 m high. Significant landscape erosion and channel incision are common throughout most of the Rio Puerco watershed (Coleman et al., 1998). The basin is one of the nation's most actively eroding watersheds. The Rio Puerco Basin has been documented to transport one of the highest known average annual sediment loads and is the major source of suspended sediment entering the Rio Grande above Elephant Butte Reservoir (Happ, 1948). A high regional surface gradient and an excess of straight drainage channel segments combines with the region's climatic setting and vulnerable sedimentary lithologies to create the watershed's dramatic erosion (Gellis, 2000). Average rainfall in the basin varies annually between 30.5 and 51 cm, delivered mostly by late summer monsoon thunderstorms that create violent flash flooding that sweeps out of well-vegetated highlands across sparsely vegetated slopes and valley surfaces, carrying away thin topsoil and weathered bedrock (Gellis, 2000).

Aluminum is the third most common element in the Earth's crust, and the most common metal. It is a major component of the geology in the Rio Puerco headwaters, as evidenced by the predominance of alumino-silicate volcanic rocks in the region. Land disturbance in the watershed likely plays a role in the magnitude of soil erosion and transport. The anthropogenic influences of road and highway construction, channelization, land development, and historical rangeland grazing practices on the highly erodible soils of the Rio Puerco watershed may be contributing to impairment in the Rio Grande. The Rio Puerco is not listed as impaired for aluminum, likely because the highest flow estimated during any of the 2011 sampling events (the most recent available data) was 1.5 cfs. The Rio Salado enters the Rio Grande eight miles south of the Rio Puerco. The channel is about a mile wide at the confluence. The lower Rio Salado channel includes extensive fields of crescent-shaped aeolian sand dunes (Evans, 1963). No water quality sampling was conducted on the Rio Puerco or Rio Salado during the 2014 survey because they are part of a separate basin from the Middle Rio Grande for planning purposes.

Aluminum is also present in fertilizers used in agriculture (USEPA, 2017). There are numerous crop fields in close proximity to the west side of the Rio Grande in the TMDL study area; all of these drain to the LFCC. Hence return water reaches the river above San Marcial only by means of the five BOR pump stations described on page 9 of this report.

On the Jemez River, the correlation between TR Al concentration and TSS exists, but is not as strong as on the Rio Grande, and exceedences were documented even at very low TSS levels. As described in Section 1.2, a major wildfire took place in the Jemez River headwaters area during the water quality survey period. Forest fires can release metals from the soil. SWQB field notes from the September 4, 2013, sampling event state that the river was "Running black with high turbidity from rains in upper watershed". The two highest aluminum concentrations were documented in September of that year, however WQS exceedences were also documented prior to the start of the Thompson Ridge fire. Aluminum is present in natural waters in a complex of chemical forms. Total aluminum has a minimum concentration between pH 6 and 7. At pH values greater than 7, aluminum concentration would be expected to increase with increasing pH. No correlation between pH and TR Al concentrations was evident based on survey data from either TMDL study area. The Jemez River was distinctly more basic below the hot springs in the Jemez Springs area, but TR Al was apparently not affected by the inflow of thermal groundwater.

2.8 Consideration of Seasonal Variation

Annual variation was accounted for in the Rio Grande TMDLs by using 42 years of USGS flow records to develop flow exceedence percentiles. Federal regulations (40 C.F.R. § 130.7(c)(1)) require that TMDLs also take into consideration seasonal variation in watershed conditions and pollutant loading. During the 2014 water quality survey, total recoverable aluminum exceedences in the TMDL study area occurred during late summer months. As can be seen on regional USGS gage records (Figures 1.10 through 1.12, on pages 19-20), the July sampling event took place during the rising leg of flow from a storm that caused the second-highest peak flow of 2014. The

September sampling event took place on the falling hydrograph from the largest storm-related flow of that year. Higher flows may flush more nonpoint source runoff containing aluminum. It is also possible a criterion may be exceeded under a low flow condition when there is insufficient dilution. The 2005 exceedences which resulted in the listing of the TMDL study area for dissolved aluminum, were documented at both the high flow and dry hydrologic zones.

TR Al WQS exceedences in the Jemez River do not exhibit any apparent relation to seasonality (see Appendix A).

2.9 Future Growth

Growth estimates by county and Water Planning Region (WPR) are available from the New Mexico Bureau of Business and Economic Research (BBER, 2008 and http://bber.unm.edu/data). These estimates project growth to the year 2060. The TMDL study area on the Rio Grande falls within the Sierra/Socorro WPR, comprising the entire land areas of Socorro and Sierra Counties. BBER projects continuing slow growth for this WPR.

The TMDL study area on the Jemez River falls within the Middle Rio Grande WPR, comprising most of the land areas of Sandoval, Bernalillo and Valencia Counties. Population dynamics in this WPR are dominated by Bernalillo County, which contains the city of Albuquerque. Because Bernalillo County is downstream of the Jemez River AUs addressed in this TMDL report, and therefore has little effect on water quality there, we report only on that portion of Sandoval County which lies within the Middle Rio Grande WPR. This estimate is probably still biased toward the Albuquerque metropolitan area, but may better represent population trends in the upper Jemez River drainage. Table 2.9 shows the BBER projected population estimates.

Table 2.9 TMDL Study Area Water Planning Region Population Estimates

TMDL Study Area	WPR	2015*	2030	2040	2050	2060	% Increase (2015-2060)
Rio Grande	Sierra/Socorro	28,538	35,515	36,277	37,188	38,244	34
Jemez River	Middle Rio Grande (Sandoval County only)	142,073	198,168	230,993	261,951	292,367	106

*most recent estimate available

According to the calculations, the overwhelming source of aluminum loading is from nonpoint sources (Tables 2.5 and 2.6). Estimates of future growth are not anticipated to lead to a significant increase in aluminum concentrations that cannot be controlled with BMP implementation and appropriate NPDES permit limits in this watershed. BMPs should be utilized and improved upon while continuing to improve watershed conditions and adhering to SWPPP requirements related to construction and industrial activities covered under the general permit.

3.0 APPLICABLE REGULATION AND REASONABLE ASSURANCES

New Mexico's Water Quality Act, NMSA 1978 §§ 74-6-1 to -17 (Act), authorizes the WQCC to "promulgate and publish regulations to prevent or abate water pollution in the state" and to require permits (NMSA 1978, § 74-6-4(E)). The Act authorizes a constituent agency to take enforcement action against any person who violates a water quality standard. Several statutory provisions on nuisance law could also be applied to NPS water pollution. The Act also states in Section 74-6-12(A):

> *The Water Quality Act does not grant to the commission or to any other entity the power to take away or modify the property rights in water, nor is it the intention of the Water Quality Act to take away or modify such rights.*

In addition, the State of New Mexico Surface Water Quality Standards (see 20.6.4.6.C NMAC) (NMAC, 2012) states:

> *Pursuant to Subsection A of Section 74-6-12 NMSA 1978, this part does not grant to the water quality control commission or to any other entity the power to take away or modify property rights in water.*

New Mexico policies are in accordance with the federal Clean Water Act §101(g) (33 U.S.C. § 1251 (g)):

> *It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this Act. It is the further policy of Congress that nothing in this Act shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.*

New Mexico's CWA §319 Program (33 U.S.C. § 1329) has been developed in a coordinated manner with the State's 303(d) process. All watersheds that are targeted in the annual §319 request for proposal process coincide with the State's biennial impaired waters list as approved by USEPA. The State has given a high priority for funding, assessment, and restoration activities to these watersheds.

As a constituent agency, NMED has the authority under Section 74-6-10 of the Act to issue a compliance order or commence civil action in district court for appropriate relief if NMED determines that actions of a "person" (as defined in the Act) have resulted in a violation of a water quality standard including a violation caused by a NPS. The NMED NPS water quality management program has historically strived for and will continue to promote voluntary compliance to NPS water pollution concerns by utilizing a voluntary, cooperative approach. The

State provides technical support and grant monies for implementation of BMPs and other NPS prevention mechanisms through §319 of the CWA. Since portions of this TMDL will be implemented through NPS control mechanisms, the New Mexico Watershed Protection Program will target efforts to this and other watersheds with TMDLs.

In order to obtain reasonable assurances for implementation in watersheds with multiple landowners, including federal, state, and private land, NMED has established Memoranda of Understanding (MOUs) with various federal agencies, in particular the U.S. Forest Service and the Bureau of Land Management. MOUs have also been developed with other state agencies, such as the New Mexico Department of Transportation. These MOUs provide for coordination and consistency in dealing with NPS issues.

The time required to attain standards for all reaches is estimated to be approximately 10-20 years. This estimate is based on a five-year time frame implementing several watershed projects that may not be starting immediately or may be in response to earlier projects. Stakeholders in this process will include SWQB, and other parties identified in the WBP. The cooperation of watershed stakeholders will be pivotal in the implementation of these TMDLs as well.

A Watershed Restoration Action Strategy (WRAS) was prepared in 2004, and revised in 2005, by the Jemez Watershed Group. WRAS documents were developed prior to the nine elements of the WBP that have been incorporated into the New Mexico Nonpoint Source Management Plan since 2009. These archival plans generally lack the quantitative elements required of WBPs, but many of them still provide useful background information for future planning. The Jemez WRAS has not been updated to a WBP and the group is no longer active. There is no approved watershed planning document for the reach of the Rio Grande addressed in the current TMDL report.

4.0 PUBLIC PARTICIPATION

Public participation was solicited in development of this TMDL, as shown on Figure 4.1. A Public Comment Draft TMDL report was made available for a 30-day comment period beginning on January 2, 2018. The draft document notice of availability was advertised via email distribution lists, webpage postings (http://www.nmenv.state.nm.us), and a press release to the Albuquerque Journal. Public meetings were held on January 10, 2018 from 5:30-7:30 pm at the Municipal Building in Jemez Springs, and on January 18, 2018 from 5:30-7:30 pm at the NM Tech University Skeen Library in Socorro. Two sets of written comments were received in response to the public comment period. Responses to comments received during the public comment period are included as Appendix C of the final TMDL report. Minor revisions were made to the Public Comment Draft in response to comments received and discussion at the public meetings.

Once the TMDL is approved by the WQCC and USEPA Region 6, the next step for public participation is development or revision of the WBP and implementation of watershed improvement projects including those that may be funded by CWA §319(h) grants. The WBP development and revision process is open to any member of the public who wants to participate.

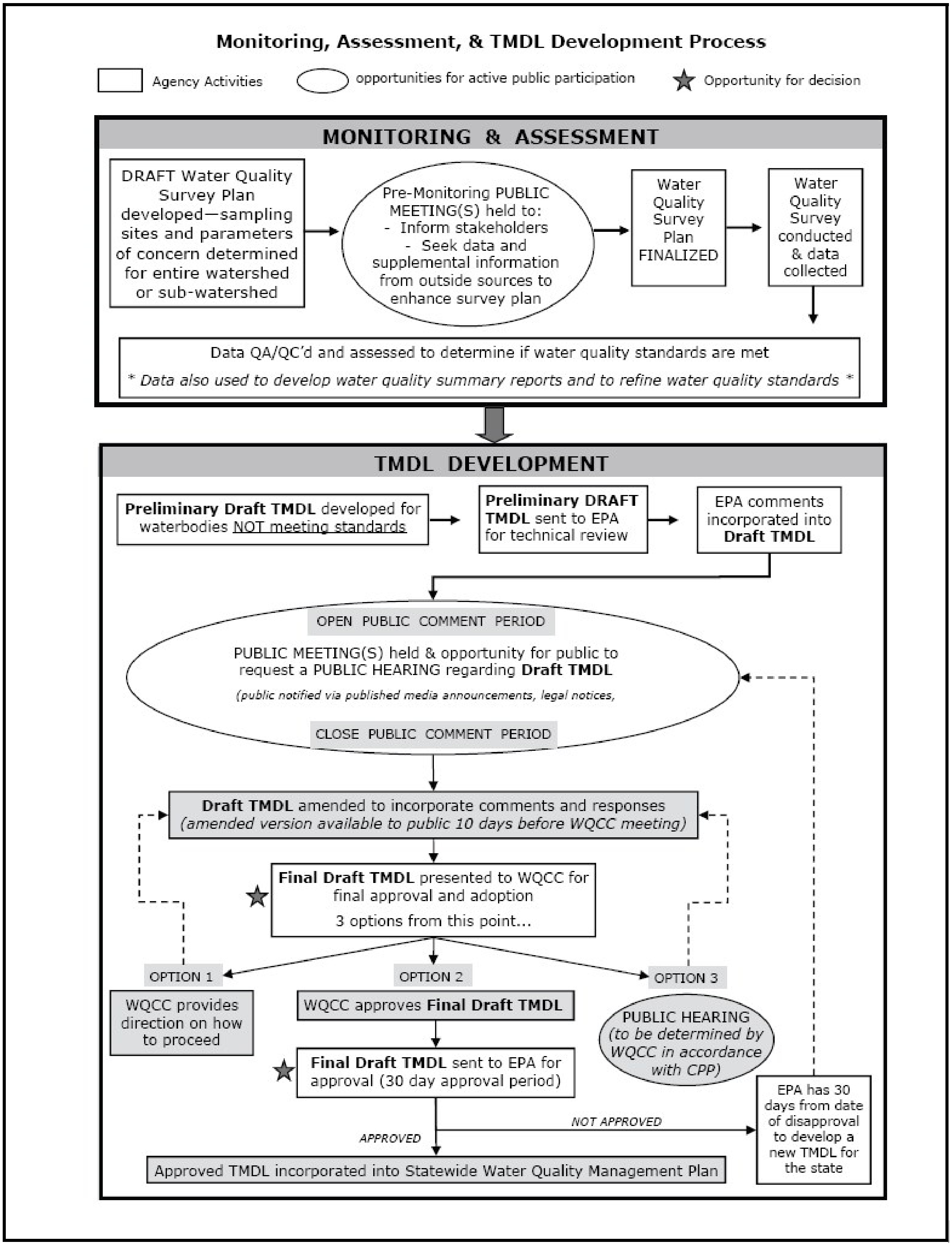


Figure 4.1. SWQB TMDL Public Participation Process

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APPENDIX A

Aluminum Data

Table A.1- Selected Field and Laboratory Variables for the Middle Rio Grande TMDL study area and the upstream AU, 2014

Station	Date	TR Al (mg/l)	Acute WQS (mg/l)	Chronic WQS (mg/l)	Flow (cfs)	pH
Above Middle Rio Grande Study Area						
32RGrand391.9	3/19/14	0.69	5.58	2.24	357	8.3
	5/13/14	0.63	5.37	2.15	984	8.2
	7/16/14	19	6.07	2.43	337	8.3
	9/2/14	0.01	9.02	3.61	113	8.7
Middle Rio Grande Study Area						
Rio Grande (Arroyo de las Canas to Rio Puerco)						
32RGrand342.5	3/18/2014	1.1	6.62	2.65	410	8.2
	5/13/2014	0.07	5.64	2.26	925	7.7
	7/16/2014	200	10.1	4.03	319	8.2
	9/2/2014	150	10.1	4.03	89.3	8.2
Rio Grande (USGS gage at San Marcial to Arroyo de las Canas)						
32RGrand292.8	3/18/2014	1.8	6.34	2.54	293	8.1
	5/12/2014	0.44	5.64	2.26	426	8.0
	7/15/2014	280	10.1	4.03	312	7.8
	9/3/2014	76	10.1	4.03	47.4	8.6
	10/8/2014	0.91	10.1	4.03	28.3	8.5

Red values indicate exceedance of the water quality standard.

Table A.2- Selected Field and Laboratory Variables for the Jemez River TMDL study area, 2013 to 2015

Station	Date	TR Al (mg/l)	Acute WQS (mg/l)	Chronic WQS (mg/l)	Flow (cfs)	pH
Jemez Study Area						
Jemez River (Soda Dam nr Jemez Springs to East Fork)						
31JemezR064.9	3/25/2013	2.5	1.78	0.712	23.1	7.4
31JemezR070.3	4/23/2013	0.55	1.15	0.459	NA	7.0
31JemezR064.9	6/18/2013	0.58	2.31	0.924	7.9	7.0
31JemezR064.9	8/24/2015	1.2	2.18	0.874	NA	7.2
31JemezR064.9	9/12/2013	14	1.78	0.712	NA	7.3
Jemez River (Rio Guadalupe to Soda Dam nr Jemez Springs)						
31JemezR049.2	3/25/2013	1.6	3.7	1.48	13.7	8.6
31JemezR049.2	6/18/2013	0.49	8.54	3.42	11.4	8.5
31JemezR049.2	8/24/2015	0.43	4.95	1.98	NA	8.7
31JemezR049.2	9/4/2013	6.5	4.54	1.82	10	7.9

Red values indicate exceedance of the water quality standard.

NA – flow was not measured or estimated

APPENDIX B

Source Documentation

"Sources" are defined as activities that may contribute pollutants or stressors to a water body (USEPA 1997). The list of "Probable Sources of Impairment" in the Integrated 303(d)/305(b) List, Total Maximum Daily Load documents (TMDLs), and Watershed-Based Plans (WBPs) is intended to include any and all activities that could be contributing to the identified cause of impairment. Data on Probable Sources is routinely gathered by Monitoring and Assessment Section staff and Watershed Protection Section staff during water quality surveys and watershed restoration projects and is housed in the Assessment Database (ADB version 2). ADB was developed by USEPA to help states manage information on surface water impairment and to generate §303(d)/ §305(b) reports and statistics. More specific information on Probable Sources of Impairment is provided in individual watershed planning documents (e.g., TMDLs, WBPs, etc.) as they are prepared to address individual impairments by assessment unit.

USEPA through guidance documents strongly encourages states to include a list of Probable Sources for each listed impairment. According to the 1998 305(b) report guidance, "…, states must always provide aggregate source category totals…" in the biennial submittal that fulfills CWA section 305(b)(1)(C) through (E) (USEPA 1997). The list of "Probable Sources" is not intended to single out any particular land owner or single land management activity and has therefore been labeled "Probable" and generally includes several sources for each known impairment.

The approach for identifying "Probable Sources of Impairment" was recently modified by SWQB. Any new impairment listing will be assigned a Probable Source of "Source Unknown." Probable Source Sheets will continue to be filled out during watershed surveys and watershed restoration activities by SWQB staff. Information gathered from the Probable Source Sheets will be used to generate a draft Probable Source list in consequent TMDL planning documents. These draft Probable Source lists will be finalized with watershed group/stakeholder input during the pre-survey public meeting, TMDL public meeting, WBP development, and various public comment periods. The final Probable Source list in the approved TMDL will be used to update the subsequent Integrated List.

Literature Cited:

USEPA. 1997. Guidelines for preparation of the comprehensive state water quality assessments (305(b) reports) and electronic uptakes. EPA-841-B-97-002A. Washington, D.C.

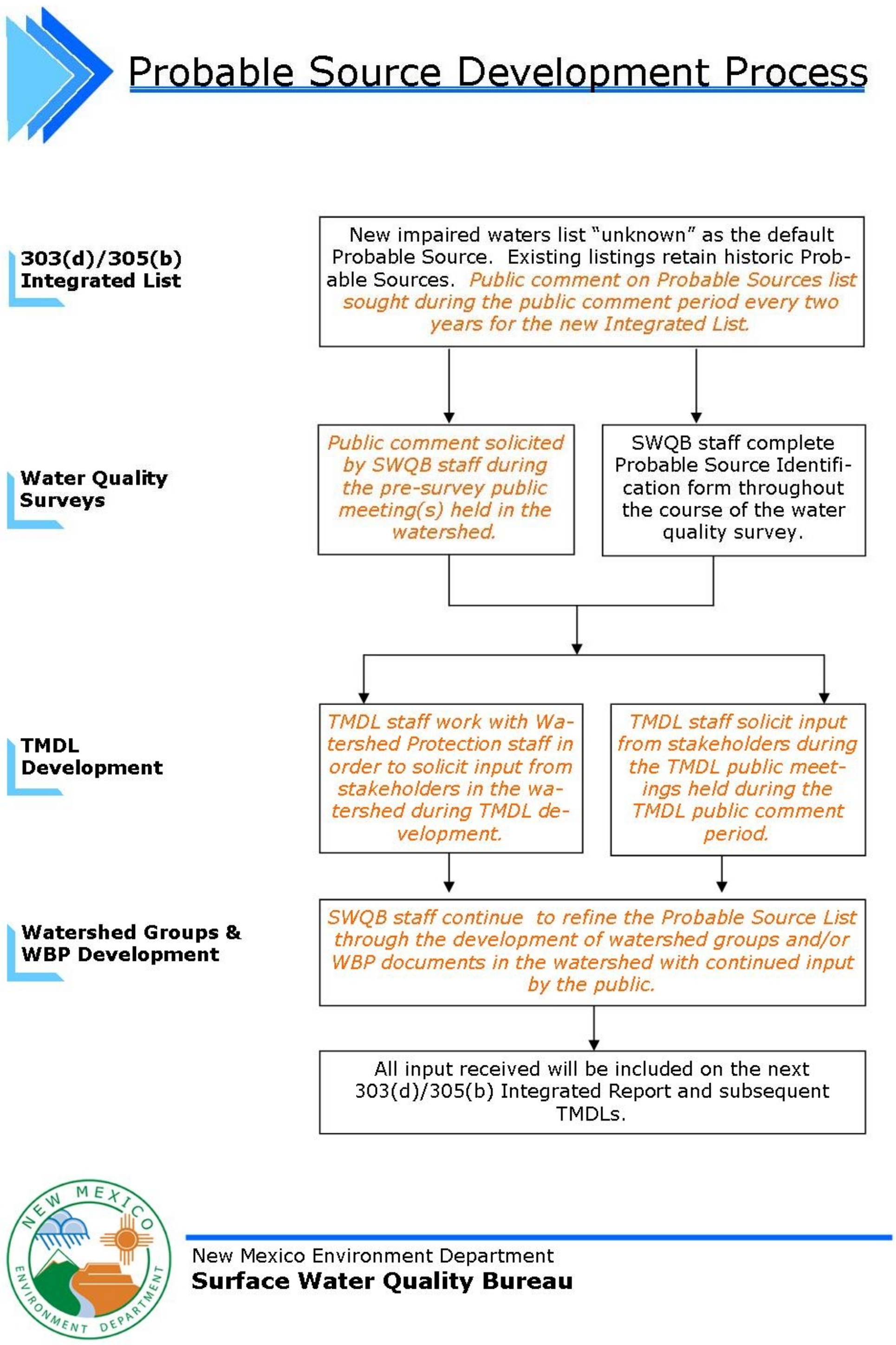

Figure A1. Probable Source Development Process and Public Participation Flowchart

Help Us Identify Probable Sources of Impairment

Name:
Phone Number (optional):
Email or Mailing Address (optional):
Date:
Waterbody or site description (example - Fish Creek near HWY 34 crossing):

From the list below, please check activities known to exist that you are concerned may be contributing to surface water quality impairment. Please score items you check based on distance to or occurrence on or near the waterbody of concern.

(1 = Low occurrence or not near waterbody)
(3 = Moderate occurrence or within ½ mile of waterbody)
(5 = High occurrence or right next to water body)

✓	ACTIVITY	Score		
☐	Feedlots	1	3	5
☐	Livestock Grazing	1	3	5
☐	Agriculture	1	3	5
☐	Flow Alterations (water withdrawal)	1	3	5
☐	Stream/River Modification(s)	1	3	5
☐	Storm Water Runoff	1	3	5
☐	Drought Related	1	3	5
☐	Landfill(s)	1	3	5
☐	Industry/Wastewater Treatment Plant	1	3	5
☐	Inappropriate Waste Disposal	1	3	5
☐	Improperly maintained Septic Systems	1	3	5
☐	Waste from Pets	1	3	5

✓	ACTIVITY	Score		
☐	Pavement and Other Impervious Surfaces	1	3	5
☐	Roads/Bridges/Culverts	1	3	5
☐	Habitat Modification(s)	1	3	5
☐	Mining/Resource Extraction	1	3	5
☐	Logging/Forestry Operations	1	3	5
☐	Housing or Land Development	1	3	5
☐	Habitat Modification	1	3	5
☐	Waterfowl	1	3	5
☐	Wildlife other than Waterfowl	1	3	5
☐	Recreational Use	1	3	5
☐	Natural Sources	1	3	5
☐	Other: *(please describe)*	1	3	5

Comments/additional information:

Revised 02Aug12

Figure A2. Probable Source Identification Sheet for the Public

Probable Source(s) & Site Condition Class Field Form

Station ID:	Station Name/Description:	
AU ID:	AU Description:	
Field Crew:	Comments:	
Date:	Watershed protection staff reviewer:	Date of WPS review:

Score the proximity, intensity and/or certainty of occurrence of the following activities in the AU upstream of the site. Consult with the appropriate staff at NMED and other agencies to score "*" cells if needed.

Activity Checklist

Hydromodifications				
Channelization	0	1	3	5
Dams/Diversions	0	1	3	5
Draining/Filling Wetlands	0	1	3	5
Dredging	0	1	3	5
Irrigation Return Drains	0	1	3	5
Riprap/Wall/Dike/Jetty Jack -- circle	0	1	3	5
Flow Alteration (from Water Diversions/Dam Ops – circle)	0	1	3	5
Highway/Road/Bridge Runoff	0	1	3	5
Other:	0	1	3	5
Habitat Modification				
Active Exotics Removal	0	1	3	5
Stream Channel Incision	0	1	3	5
Mass Wasting	0	1	3	5
Active Restoration	0	1	3	5
Other:	0	1	3	5
Industrial/ Municipal				
Storm Water Runoff due to Construction	0	1	3	5
Landfill	0	1	3	5
On-Site Treatment Systems (Septic, etc.)	0	1	3	5
Pavement/Impervious Surfaces	0	1	3	5
Inappropriate Waste Disposal	0	1	3	5
Residences/Buildings	0	1	3	5
Site Clearance (Land Development)	0	1	3	5
Urban Runoff/Storm Sewers	0	1	3	5
Power Plants	0	1	3	5
* Industrial Storm Water Discharge (permitted)	0	1	3	5
* Industrial Point Source Discharge	0	1	3	5
* Municipal Point Source Discharge	0	1	3	5
* RCRA/Superfund Site	0	1	3	5
Other:	0	1	3	5
Resource Extraction				
* Abandoned Mines (Inactive)/Tailings	0	1	3	5
* Acid Mine Drainage	0	1	3	5
* Active Mines (Placer/Potash/Other -- circle)	0	1	3	5
* Oil/Gas Activities (Permitted/Legacy – circle)	0	1	3	5
* Active Mine Reclamation	0	1	3	5
Other:	0	1	3	5

Silviculture				
* Logging Ops – Active Harvesting	0	1	3	5
* Logging Ops – Legacy	0	1	3	5
* Fire Suppression (Thinning/Chemicals)	0	1	3	5
Other:	0	1	3	5
Rangeland				
Livestock Grazing or Feeding Operation	0	1	3	5
Rangeland Grazing (dispersed)	0	1	3	5
Other:	0	1	3	5
Roads				
Bridges/Culverts/RR Crossings	0	1	3	5
Low Water Crossing	0	1	3	5
Paved Roads	0	1	3	5
Gravel or Dirt Roads	0	1	3	5
Agriculture				
Crop Production (Cropland or Dry Land)	0	1	3	5
Irrigated Crop Production (Irrigation Equip)	0	1	3	5
* Permitted CAFOs	0	1	3	5
* Permitted Aquaculture	0	1	3	5
Other:	0	1	3	5
Miscellaneous				
Angling Pressure	0	1	3	5
Dumping/Garbage/Trash/Litter	0	1	3	5
Exotic Species (describe in comments)	0	1	3	5
Hiking Trails	0	1	3	5
Campgrounds (Dispersed/Defined – circle)	0	1	3	5
Surface Films/Odors	0	1	3	5
Pesticide Application (Algaecide/Insecticide)	0	1	3	5
Waste From Pets (high concentration)	0	1	3	5
* Fish Stocking	0	1	3	5
Other:	0	1	3	5
Natural Disturbance or Occurrence				
Waterfowl	0	1	3	5
Drought-related Impacts	0	1	3	5
Watershed Runoff Following Forest Fire	0	1	3	5
Recent Bankfull or Overbank Flows	0	1	3	5
Wildlife other than Waterfowl	0	1	3	5
Other Natural Sources (describe in comments)	0	1	3	5

Legend – Proximity Score

Activity not known occur within AU upstream of station (includes unknown)	0	Activity observed or known to be present near station (1 km or less) or is known to occur in moderate frequency/intensity within the AU upstream of station	3
Activity observed or known to be present but not near the station and at low frequency/intensity within AU upstream of station	1	Activity observed or known to be present at station or known to occur in high frequency/intensity within the AU upstream of station	5

Figure A3. Probable Source & Site Condition Field Sheet for SWQB Staff

APPENDIX C

Response to Public Comments

The following changes have been made to the Aluminum TMDL Updates for the Middle Rio Grande Basin Public Draft document:

1. Clarification of how WLA was calculated, pp. 30-31 (internal comment)
2. Spelling of NMDGF property name (public comment)
3. Table 2.5 re-arranged for clarity/comparability (public meeting discussion)
4. Tildes added to place names (internal comment)
5. Added flow control structure photos as Figure 1.4 (additional information)
6. Added AU color-coding to MRG Land Ownership map, Figure 1.5 (internal comment)
7. Added Cajete Fire perimeter to Figure 1.9 (public comment)
8. Revised text discussion of flow control operations, p. 9 (additional information)
9. Updated Public Participation section and added public comments to Appendix C (additional information)

Two sets of public comments were received:

1. Malia Volke, Ph.D., New Mexico Department of Game and Fish
2. Kathryn Kruthaupt, New Mexico Department of Agriculture

Comment Set 1:

Dear Rachel,

I have a few editorial comments for the TMDL Updates for the Middle Rio Grande Basin draft document.

Page 9: "La Hoya" should be changed to "La Joya".

NMED Response: The spelling correction has been made.

Page 13: You may want to reference the Cajete Fire that occurred during 2017. https://inciweb.nwcg.gov/incident/5251/

NMED Response: A description of the Cajete fire has been added to the report.

Page 14, Figure 1.8: You may want to add the Cajete Fire to this map.

NMED Response: The perimeter of the Cajete fire has been added to the map (now Figure 1.9).

Thanks, let me know if you have any questions.

Malia

Malia Volke, Ph.D.
Aquatic & Riparian Habitat Specialist
Ecological and Environmental Planning Division
New Mexico Department of Game & Fish
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CONSERVING NEW MEXICO'S WILDLIFE FOR FUTURE GENERATIONS

Comment Set 2:

NM STATE UNIVERSITY

New Mexico Department of Agriculture
Agricultural Programs and Resources Division
MSC APR
New Mexico State University
P.O. Box 30005
Las Cruces, NM 88003-8005
575-646-2642, fax: 575-646-1540

January 30, 2018

Ms. Rachel Jankowitz
NMED SWQB
P.O. Box 5469
Santa Fe, NM 87502

RE: Aluminum TMDL Updates for the Middle Rio Grande Basin and Jemez River

Dear Ms. Jankowitz:

New Mexico Department of Agriculture (NMDA) submits the following comments regarding the *Aluminum* Draft Total Maximum Daily Load Updates (Draft TMDL) recently published by New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB) for the Middle Rio Grande Basin and Jemez River. Our comments are specific to our mission within state government – dedication to the promotion and enhancement of New Mexico's agriculture, natural resources, and quality of life.

Section 2.7 of the Draft TMDL presents information on how the SWQB assesses the probable sources of impairment. Based on the description of the development of the list of probable sources, it appears that SWQB staff diligently work with stakeholders to identify problems. While it is commendable to work with the public to develop these lists, the lists do not appear to be subject to scientific analysis.

The Draft TMDL states that it is beyond the resources of the SWQB's analysis to perform extensive data collection and analyses necessary to determine aluminum loads in the Middle Rio Grande Basin and Jemez River. The Draft TMDL mentions that some of the probable pollutant sources of impairment are: rangeland grazing and irrigated crop production. The relative contribution of different potential sources contributing to the aluminum load cannot be determined and the list of probable sources is only a hypothesis without performing an extensive data collection and analyses of the nutrient load. As currently written, there are no safeguards preventing a popular opinion from causing one or several categories being overrepresented. NMDA requests that SWQB provide the specific scientifically valid sources for the nutrient load in order for the public and end users of the forthcoming final TMDL to have accurate information.

NMDA appreciates the opportunity to provide comments on the Draft TMDL for the Middle Rio Grande Basin and Jemez River. Please contact Ms. Kathryn Kruthaupt at (575) 646-2006 or kkruthaupt@nmda.nmsu.edu with any questions or concerns regarding these comments.

Sincerely,

Kathryn Kruthaupt

for Julie Maitland

JM/kk

NMED Response:

The inclusion of livestock grazing and irrigated crop production on the list of probable sources is supported by a large body of peer-reviewed literature documenting potential adverse effects on water quality. While it would be ideal to have site-specific monitoring data for a number of variables, including grazing and irrigated crop production, it is beyond the available resources of the SWQB to do so. NMED does not state or imply that grazing or farming is the primary source of aluminum impacts in the watershed. As stated in Section 2.7 of the TMDL document, the probable sources list is a starting point to be refined or revised in the process of Watershed Based Plan (WBP) development, and does not single out any particular source or land owner. It is outside the scope of the TMDL to address probable sources in greater detail. The completion of a TMDL can lead to opportunities for subsequent monitoring, planning and restoration activities to address watershed conditions that contribute to the aluminum impairments, through an approved WBP and application for grant funding.

NMED has added language clarifying the purpose and utility of the probable source list, to mitigate misinterpretation or overrepresentation of a specific source or land use. If the NM Dept. of Agriculture has any specific suggestions for "safeguards preventing a popular opinion from causing one or several categories being overrepresented," NMED will consider them.